

ji Pemahaman Halaman 131

.. Pilihan Ganda

$$A(3, -2) \xrightarrow{T = \begin{pmatrix} 3 \\ -4 \end{pmatrix}} A'(3+3, -2+(-4)) \\ = A'(6, -6)$$

Jawaban: D

$$B(-1, -4) \xrightarrow{T = \begin{pmatrix} 4 \\ -2 \end{pmatrix}} B'(-1+4, -4+(-2)) \\ = B'(3, -6)$$

Jawaban: C.

$$A(7, -6) \xrightarrow{T = \begin{pmatrix} h \\ k \end{pmatrix}} A'(-7, 5)$$

$$\Rightarrow -7 = 7 + h \Leftrightarrow h = -14$$

$$\circ 5 = -6 + k \Leftrightarrow k = 11$$

$$\Rightarrow h + k = -14 + 11 = -3$$

Jawaban: C

$$C(m, n) \xrightarrow{T = \begin{pmatrix} 5 \\ 0 \end{pmatrix}} C'(0, 5)$$

$$\Rightarrow m + 5 = 0 \Leftrightarrow m = -5$$

$$\circ n + 0 = 5 \Leftrightarrow n = 5$$

$$\Rightarrow m^2 + n^2 = (-5)^2 + 5^2 = 25 + 25 = 50$$

Jawaban: D

$$5. \quad T = \begin{pmatrix} -10 \\ 7 \end{pmatrix} \\ A \xrightarrow{\quad} A'(2, -13)$$

$$\Rightarrow x_A + (-10) = 2 \Leftrightarrow x_A = 12$$

$$\circ y_A + 7 = -13 \Leftrightarrow y_A = -20$$

$$\therefore A(12, -20)$$

Jawaban: E.

6.

$$(x, y) \xrightarrow{T = \begin{pmatrix} -1 \\ 2 \end{pmatrix}} (x', y')$$

$$\Rightarrow x' = x + (-1) \Leftrightarrow x = x' + 1$$

$$\circ y' = y + 2 \Leftrightarrow y = y' - 2$$

$$\therefore \text{Bayangan garis } y + x = 0$$

$$\Leftrightarrow (y - 2) + (x + 1) = 0$$

$$\Leftrightarrow y + x = 1$$

Jawaban: A

$$7. \quad x' = x + 10 \Leftrightarrow x = x' - 10$$

$$y' = y + (-5) \Leftrightarrow y = y' + 5$$

$$\circ 5x - 6y + 30 = 0$$

$$\Leftrightarrow 5(x' - 10) - 6(y' + 5) + 30 = 0$$

$$\Leftrightarrow 5x' - 50 - 6y' - 30 + 30 = 0$$

$$\Leftrightarrow 5x' - 6y' - 50 = 0$$

$$\therefore \text{Bayangan garis } 5x - 6y + 30 = 0$$

$$\text{adalah garis } 5x - 6y - 50 = 0$$

Jawaban: A.

$$8. \quad T = \begin{pmatrix} -3 \\ -6 \end{pmatrix} \Rightarrow x' = x + (-3) \Leftrightarrow x = x' + 3 \\ y' = y + (-6) \Leftrightarrow y = y' + 6$$

$$\circ 3x - 4y - 12 = 0$$

$$\Leftrightarrow 3(x' + 3) - 4(y' + 6) - 12 = 0$$

$$\Leftrightarrow 3x' + 9 - 4y' - 24 - 12 = 0$$

$$\Leftrightarrow 3x' - 4y' - 27 = 0$$

$$\therefore \text{Bayangan garis } 3x - 4y - 12 = 0$$

$$\text{adalah } 3x - 4y - 27 = 0$$

Jawaban: D.

$$9. \quad T = \begin{pmatrix} 6 \\ -10 \end{pmatrix} \Rightarrow x' = x + 6 \Leftrightarrow x = x' - 6 \\ y' = y + (-10) \Leftrightarrow y = y' + 10$$

$$\circ y = x^2 + 4x + 13$$

$$\Leftrightarrow y' + 10 = (x' - 6)^2 + 4(x' - 6) + 13$$

$$\textcircled{1} \quad \Leftrightarrow y' + 10 = x'^2 - 12x' + 36 + 4x' - 24 + 13$$

$$\Leftrightarrow y' = x'^2 - 8x' + 15$$

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∴ Bayangan garis $y = x^2 + 4x + 13$
adalah garis $y = x^2 - 8x + 15$

Jawaban: D

$$0. \ell' \Leftrightarrow y = 2x^2 - 12x + 17 \quad \text{---} \quad T = \begin{pmatrix} a \\ b \end{pmatrix}$$

$$\ell \Leftrightarrow y = 2x^2 + 4x + 3$$

$$\Rightarrow \circ x = x' - a; y = y' - b$$

$$\Rightarrow \ell' \Leftrightarrow y' - b = 2(x' - a)^2 + 4(x' - a) + 3$$

$$\Leftrightarrow y' = 2(x'^2 - 2ax + a^2) + 4x' - 4a + 3 - b$$

$$\Leftrightarrow y' = 2x'^2 + (4 - 4a)x + (2a^2 - 4a + 3 - b)$$

$$\text{Karena } \ell' \Leftrightarrow y = 2x^2 - 12x + 17$$

$$\Rightarrow \circ -12 = 4 - 4a \Leftrightarrow 4a = 16 \Leftrightarrow a = 4.$$

$$\circ 2a^2 - 4a + 3 - b = 17$$

$$\Leftrightarrow b = 2a^2 - 4a - 14$$

$$= 2(4)^2 - 4(4) - 14$$

$$= 2$$

$$\therefore a - b = 4 - 2 = 2.$$

Jawaban: C.

B. Uraian

$$1. A \xrightarrow{T} A' = B, T = \begin{pmatrix} x \\ y \end{pmatrix}; A(1, 4); B(2, 0)$$

$$a). \circ 1 + x = 2 \Leftrightarrow x = 1$$

$$\circ 4 + y = 0 \Leftrightarrow y = -4 \Rightarrow T = \begin{pmatrix} 1 \\ -4 \end{pmatrix}$$

$$b). \circ A' = B = (2, 0)$$

$$\circ B' = (2 + 1, 0 + (-4)) = (3, -4)$$

$$\circ C(-3, 3) \Rightarrow C' = (-3 + 1, 3 + (-4)) = (-2, -1)$$

$$2. a) \Delta KLM \xrightarrow{T_1} \Delta ABC \Rightarrow K \xrightarrow{T_1} A; T_1 = \begin{pmatrix} x_1 \\ y_1 \end{pmatrix}$$

$$\circ K(5, -1); A(2, 2)$$

$$\Rightarrow \circ 5 + x_1 = 2 \Leftrightarrow x_1 = -3$$

$$\circ -1 + y_1 = 2 \Leftrightarrow y_1 = 3 \Rightarrow T_1 = \begin{pmatrix} -3 \\ 3 \end{pmatrix}$$

$$b). \Delta KLM \xrightarrow{T_2} \Delta PQR; T_2 = \begin{pmatrix} x_2 \\ y_2 \end{pmatrix}$$

$$\circ K(5, -1); P(7, 5)$$

$$\Rightarrow \circ 5 + x_2 = 7 \Leftrightarrow x_2 = 2 \Rightarrow T_2 = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$$

$$\circ -1 + y_2 = 5 \Leftrightarrow y_2 = 6$$

c). Berdasarkan gambar.

$$A(2, 2); B(4, 4); C(2, 5);$$

$$P(7, 5); Q(9, 7); R(7, 8).$$

$$3. a). A(3, 1) \text{ dan } T = \begin{pmatrix} 7 \\ 6 \end{pmatrix}$$

$$\Rightarrow A' = (3 + 7, 1 + 6) = (10, 7)$$

$$b). A(-2, 8); T = \begin{pmatrix} -1 \\ 2 \end{pmatrix} \Rightarrow A' = (-2 + (-1), 8 + 2) = (-3, 10).$$

$$c). A(4, 0); T = \begin{pmatrix} 0 \\ 4 \end{pmatrix} \Rightarrow A' = (4 + 0, 0 + 4) = A'(4, 4)$$

$$d). A(0, -5); T = \begin{pmatrix} 8 \\ -6 \end{pmatrix}$$

$$\Rightarrow A' = (0 + 8, -5 + (-6)) = (8, -11).$$

4. misalkan $B(x, y)$

$$a). B'(7, 3); T = \begin{pmatrix} 2 \\ 2 \end{pmatrix}$$

$$\Rightarrow \circ x + 2 = 7 \Leftrightarrow x = 5 \Rightarrow B(5, 1)$$

$$\circ y + 2 = 3 \Leftrightarrow y = 1$$

$$b). B'(-5, 13); T = \begin{pmatrix} -3 \\ 1 \end{pmatrix}$$

$$\Rightarrow \circ x + (-3) = -5 \Leftrightarrow x = -2 \Rightarrow B(-2, 12).$$

$$\circ y + 1 = 13 \Leftrightarrow y = 12$$

$$c). B'(8, 3); T = \begin{pmatrix} -5 \\ 2 \end{pmatrix}$$

$$\Rightarrow \circ x + (-5) = 8 \Leftrightarrow x = 13 \Rightarrow B(13, 1)$$

$$\circ y + 2 = 3 \Leftrightarrow y = 1$$

$$d). B'(0, -4); T = \begin{pmatrix} -5 \\ 0 \end{pmatrix}$$

$$\Rightarrow \circ x + (-5) = 0 \Leftrightarrow x = 5 \Rightarrow B(5, -4).$$

$$\circ y + 0 = -4 \Leftrightarrow y = -4$$

$$5. \begin{pmatrix} -2 \\ 3 \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix} + \begin{pmatrix} 7 \\ -9 \end{pmatrix} + \begin{pmatrix} -10 \\ 6 \end{pmatrix} = \begin{pmatrix} -9 \\ -12 \end{pmatrix}$$

$$\Rightarrow a = -9 - (-2 + 7 + (-10)) = 1 \Rightarrow QR = \begin{pmatrix} 1 \\ -12 \end{pmatrix}$$

$$b = -12 - (3 + (-9) + 6) = -12$$

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$$A \xrightarrow{T} A'; T = \begin{pmatrix} x \\ y \end{pmatrix}; A(3, 2); A'(-2, -1)$$

$$a). \begin{aligned} 0 - 2 &= 3 + x \Leftrightarrow x = -5 \\ 0 - 1 &= 2 + y \Leftrightarrow y = -3 \end{aligned} \Rightarrow T = \begin{pmatrix} -5 \\ -3 \end{pmatrix}$$

$$b). P(-2, 6) \xrightarrow{T = \begin{pmatrix} -5 \\ -3 \end{pmatrix}} P'(-2 + (-5), 6 + (-3)) = P'(-7, 3)$$

2. Penentuan komponen translasi \vec{AE}

• Cara I (melihat perpindahan/pergeseran)

Dari A ke E mengalami pergeseran

• Sumbu mendatar: 4 ke kiri

• Sumbu tegak: 2 ke atas

$$\therefore \vec{AE} = \begin{pmatrix} -4 \\ 2 \end{pmatrix}$$

• Cara II (melakukan akumulasi translasi)

$$\begin{aligned} \vec{AE} &= \vec{AB} + \vec{BC} + \vec{CD} + \vec{DE} \\ &= \begin{pmatrix} 3 \\ 1 \end{pmatrix} + \begin{pmatrix} -1 \\ 5 \end{pmatrix} + \begin{pmatrix} -4 \\ 1 \end{pmatrix} + \begin{pmatrix} -2 \\ -4 \end{pmatrix} \\ &= \begin{pmatrix} -4 \\ 2 \end{pmatrix} \end{aligned}$$

$$8. P(-12, 4) \xrightarrow{T = \begin{pmatrix} h \\ k \end{pmatrix}} P'(-9, 7)$$

$$\Rightarrow \begin{aligned} -9 &= -12 + h \Leftrightarrow h = 3 \\ 7 &= 4 + k \Leftrightarrow k = 3 \end{aligned}$$

$$\therefore h = 3 \text{ dan } k = 3$$

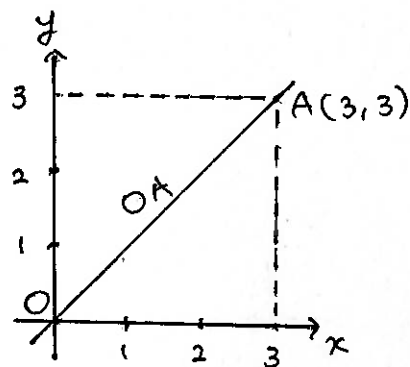
$$9. a). \text{misalkan } T = \begin{pmatrix} a \\ b \end{pmatrix}$$

$$a) \text{ karena } (-5, 9) \xrightarrow{T} (2, -12)$$

$$\begin{aligned} \Rightarrow -5 + a &= 2 \Leftrightarrow a = 7 \\ 9 + b &= -12 \Leftrightarrow b = -21 \end{aligned} \Rightarrow T = \begin{pmatrix} 7 \\ -21 \end{pmatrix}$$

$$b). P(-9, 7) \xrightarrow{T} P'(-9 + 7, 7 + (-21)) = P'(-2, -14)$$

10. a).



OA : Garis lurus

$$\Rightarrow OA \Leftrightarrow y = x + c$$

$$\bullet (0, 0) \in OA \Rightarrow 0 = 0 + c \Rightarrow c = 0$$

$$\therefore OA : y = x$$

$$b). O \xrightarrow{T} O' \quad \text{dimana } T = \begin{pmatrix} 0 \\ 5 \end{pmatrix}$$

$$(i) O' (0 + 0, 0 + 5) = O' (0, 5)$$

$$A' (3 + 0, 3 + 5) = A' (3, 8)$$

(ii) misalkan $(x, y) \in OA$

$$\Rightarrow (x, y) \xrightarrow{T} (x', y'), \text{ dimana } (x', y') \in O'A'$$

$$6x' = x + 0 \Leftrightarrow x = x'$$

$$\bullet y' = y + 5 \Leftrightarrow y = y' - 5$$

$$\Rightarrow OA \Leftrightarrow x = y$$

$$\Leftrightarrow x' = y' - 5$$

$$\Leftrightarrow y' = x' + 5$$

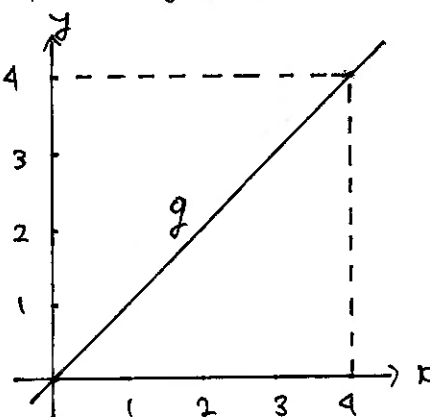
\therefore Persamaan garis $O'A'$ adalah

$$y = x + 5$$

$$11. g : y = x$$

$$\bullet x = 0 \Rightarrow y = 0$$

$$\bullet x = 3 \Rightarrow y = 3$$



Jji Pemahaman Halaman 131

a). $T = \begin{pmatrix} 0 \\ 4 \end{pmatrix} \Rightarrow \begin{matrix} \circ x' = x + 0 (\Rightarrow) x = x' \\ \circ y' = y + 4 (\Rightarrow) y = y' - 4 \end{matrix}$

$\Rightarrow g (\Rightarrow) y = x (\Rightarrow) y' - 4 = x' (\Rightarrow) y' = x' + 4$

$\therefore g' : y = x + 4$

b). $T = \begin{pmatrix} -1 \\ 3 \end{pmatrix} \Rightarrow \begin{matrix} \circ x' = x + (-1) (\Rightarrow) x = x' + 1 \\ \circ y' = y + 3 (\Rightarrow) y = y' - 3 \end{matrix}$

$\Rightarrow g (\Rightarrow) y = x (\Rightarrow) y' - 3 = x' + 1 (\Rightarrow) y' = x' + 4$

$\therefore g' : y = x + 4$

12. \circ kurva $y = x^2$

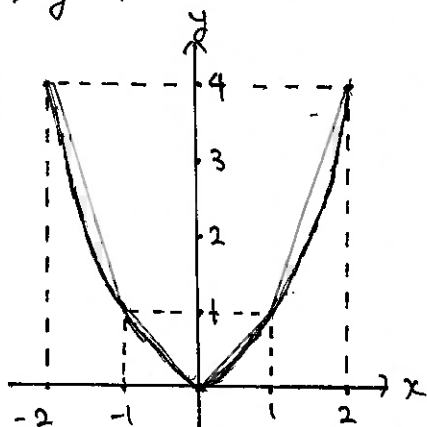
$\square x = 0 \Rightarrow y = 0$

$\square x = -1 \Rightarrow y = 1$

$\square x = 1 \Rightarrow y = 1$

$\square x = -2 \Rightarrow y = 4$

$\square x = 2 \Rightarrow y = 4$



a). $T = \begin{pmatrix} 1 \\ 3 \end{pmatrix} \Rightarrow \begin{matrix} \circ x' = x + 1 (\Rightarrow) x = x' - 1 \\ \circ y' = y + 3 (\Rightarrow) y = y' - 3 \end{matrix}$

$\circ y = x^2 (\Rightarrow) y' - 3 = (x' - 1)^2$

$(\Rightarrow) y' = x'^2 - 2x' + 1 + 3$

\therefore Bayangan parabola $y = x^2$ adalah

$y = x^2 - 2x + 1 + 3$

b). $y = x^2 \xrightarrow{T = \begin{pmatrix} a \\ b \end{pmatrix}} (y + b) = (x + a)^2 \dots$

$\Rightarrow y' = y + b$ dan $x' = x + a$

\circ Karena persamaan bayangan didapatkan setelah menghapus aksesoris "x" maka bayangan $(\Rightarrow) (y' + 5) = (x' - 4)^2$

$(\Rightarrow) (y + b + 5) = (x + a - 4)^2$

$\therefore a = 4$ dan $b = -5$

13. $p: y = x^2 - 6x + 8$

$\circ T = \begin{pmatrix} -5 \\ 2 \end{pmatrix} \Rightarrow \begin{matrix} x' = x + (-5) (\Rightarrow) x = x' + 5 \\ y' = y + 2 (\Rightarrow) y = y' - 2 \end{matrix}$

$\therefore p' (\Rightarrow) (y - 2) = (x + 5)^2 - 6(x + 5) + 8$

$(\Rightarrow) y = x^2 + 10x + 25 - 6x - 30 + 8 + 2$

$(\Rightarrow) y = x^2 + 4x + 5$

14. $p: y = -x^2 - 17x - 31$

$\circ T = \begin{pmatrix} 6 \\ -4 \end{pmatrix} \Rightarrow \begin{matrix} x' = x + 6 (\Rightarrow) x = x' - 6 \\ y' = y + (-4) (\Rightarrow) y = y' - 4 \end{matrix}$

$\circ p (\Rightarrow) y = -x^2 - 17x - 31$

$(\Rightarrow) (y' - 4) = -(x' - 6)^2 - 17(x' - 6) - 31$

$(\Rightarrow) y' - 4 = -(x'^2 - 12x' + 36) - 17x' + 102 - 31$

$(\Rightarrow) y' = -x'^2 + 12x' - 17x' - 36 + 102 - 31 + 4$

$(\Rightarrow) y' = -x'^2 - 5x' + 35$

$\therefore p' : y = -x^2 - 5x + 35$

15. $g: 8x - 9y + 72 = 0$

$\circ x' = x + 3 (\Rightarrow) x = x' - 3$
a). $T = \begin{pmatrix} 3 \\ -4 \end{pmatrix} \Rightarrow y' = y + (-4) (\Rightarrow) y = y' - 4$

$\circ g \Rightarrow 8x - 9y + 72 = 0$

$(\Rightarrow) 8(x' - 3) - 9(y' - 4) + 72 = 0$

$(\Rightarrow) 8x' - 9y' + 12 = 0$

$\therefore g' : 8x - 9y + 12 = 0$

b). $T = \begin{pmatrix} 2 \\ 6 \end{pmatrix} \Rightarrow \begin{matrix} x' = x + 2 (\Rightarrow) x = x' - 2 \\ y' = y + 6 (\Rightarrow) y = y' - 6 \end{matrix}$

$\circ g \Rightarrow 8x - 9y + 72 = 0$

$(\Rightarrow) 8(x' - 2) - 9(y' - 6) + 72 = 0$

$(\Rightarrow) 8x' - 9y' - 16 + 54 + 72 = 0$

$(\Rightarrow) 8x' - 9y' + 110 = 0$

$\therefore g' : 8x - 9y + 110 = 0$

Uji Pemahaman Halaman 143

A. Memasangkan

$$1. A(-5, 3) \xrightarrow{M_{x=-2}} A'(2(-2) - (-5), 3) \\ = A'(1, 3)$$

Jawaban: D

$$2. P(-3, 2) \xrightarrow{M_{y=-3}} P'(-3, 2(-3) - 2) \\ = P'(-3, -8)$$

Jawaban: B.

$$3. B(-2, -4) \xrightarrow{M_{y=4}} B'(-2, 2(4) - (-4)) \\ = B'(-2, 12)$$

Jawaban: A

$$4. Q \xrightarrow{M_x} Q'(x', y') ; Q(3, -7) \\ \Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} 3 \\ -7 \end{pmatrix} = \begin{pmatrix} 3 \\ 7 \end{pmatrix} \\ \therefore Q'(3, 7)$$

Jawaban: C

$$5. C(6, -4) \xrightarrow{M_{y=-x}} C'(x', y') \\ \Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 6 \\ -4 \end{pmatrix} = \begin{pmatrix} -(-4) \\ -6 \end{pmatrix} = \begin{pmatrix} 4 \\ -6 \end{pmatrix} \\ \therefore C'(4, -6)$$

Jawaban: E

B. Pilihan Ganda

$$1. A(p, q) \xrightarrow{M_{y=-x}} A'(2, 3) \\ \Rightarrow 2 = -q \Leftrightarrow q = -2 \\ \quad 3 = -p \Leftrightarrow p = -3 \\ \Rightarrow p^2 - q^2 = (-3)^2 - (-2)^2 = 9 - 4 = 5$$

Jawaban: E

$$2. \text{Pencerminan terhadap garis } y+x=0 \Leftrightarrow y=-x$$

$$P(-1, 5) \xrightarrow{M_{y=-x}} P'(-5, -(-1)) \\ = P'(-5, 1)$$

Jawaban: B

$$3. \text{misalkan } l: 2x + 3y + 6 = 0$$

$$\circ (x, y) \xrightarrow{M_{x=3}} (x', y') \\ \Rightarrow \begin{cases} x' = 2(3) - x \Leftrightarrow x = 6 - x' \\ y' = y \Leftrightarrow y = y' \end{cases}$$

$$\square l \Leftrightarrow 2x + 3y + 6 = 0 \\ \Leftrightarrow 2(6 - x') + 3y' + 6 = 0 \\ \Leftrightarrow 12 - 2x' + 3y' + 6 = 0 \\ \Leftrightarrow 2x' - 3y' = 18$$

$$\therefore l': 2x - 3y = 18$$

Jawaban: E

$$4. \text{Misalkan garis } l: 3x - y - 7 = 0$$

$$\circ (x, y) \xrightarrow{M_y} (x', y') \\ \Rightarrow \begin{cases} x' = -x \Leftrightarrow x = -x' \\ y' = y \Leftrightarrow y = y' \end{cases}$$

$$\square l \Leftrightarrow 3x - y - 7 = 0 \\ \Leftrightarrow 3(-x') - y' - 7 = 0 \\ \Leftrightarrow 3x' + y' + 7 = 0$$

$$\therefore l': 3x + y + 7 = 0$$

Jawaban: B.

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Jji Pemahaman Halaman 143

1. Misalkan garis $l: 2x + y - 3 = 0$

$$\square (x, y) \xrightarrow{M_{y=x}} (x', y')$$

$$\Rightarrow \circ x' = y \Leftrightarrow y = x'$$

$$\circ y' = x \Leftrightarrow x = y'$$

$$\circ l \Leftrightarrow 2x + y - 3 = 0$$

$$\Leftrightarrow 2y' + x' - 3 = 0$$

$$\Leftrightarrow x' + 2y' - 3 = 0$$

$$\therefore l': x + 2y - 3 = 0$$

Jawaban: A.

6. Misalkan garis $l: 2x + y - 1 = 0$

$$\square (x, y) \xrightarrow{M_x} (x', y') \xrightarrow{M_y} (x'', y'')$$

$$\Rightarrow \circ x'' = -x' ; x' = x$$

$$\Rightarrow x'' = -x \Leftrightarrow x = -x''$$

$$\circ y'' = y' ; y' = -y$$

$$\Rightarrow y'' = -y \Leftrightarrow y = -y''$$

$$\circ l: 2x + y - 1 = 0$$

$$\Leftrightarrow 2(-x'') + (-y'') - 1 = 0$$

$$\Leftrightarrow 2x'' + y'' + 1 = 0$$

$$\therefore \text{garis } l'': 2x + y + 1 = 0$$

Jawaban: E

$$7. \begin{array}{l} l: y = x^2 - 8x + 15 \\ l': y = x^2 - 4x + 3 \end{array} \quad \left. \begin{array}{l} \\ \end{array} \right\} M_{x=k}$$

$$\square (x, y) \xrightarrow{M_{x=k}} (x', y')$$

$$\Rightarrow \circ x' = 2k - x \Leftrightarrow x = 2k - x'$$

$$\circ y' = y \Leftrightarrow y = y'$$

$$\circ l \Leftrightarrow y = x^2 - 8x + 15$$

$$\Leftrightarrow y' = (2k - x')^2 - 8(2k - x') + 15$$

$$= x'^2 - 4kx' + 4k^2 - 16k + 8x' + 15$$

$$l \Rightarrow y' = x'^2 - (4k - 8)x' + (4k^2 - 16k + 15)$$

$$\text{karena } l': y = x^2 - 4x + 3$$

$$\Rightarrow 4k - 8 = 4 \Leftrightarrow 4k = 12 \Leftrightarrow k = 3.$$

Jawaban: D

$$8. (x, y) \xrightarrow{M_x} (x', y')$$

$$\Rightarrow \circ x' = x \Leftrightarrow x = x'$$

$$\circ y' = -y \Leftrightarrow y = -y'$$

$$\circ y = x^2 - 4x - 3$$

$$\Leftrightarrow -y' = -x'^2 - 4x' - 3$$

$$\Leftrightarrow y' = x'^2 + 4x' + 3.$$

$$\therefore \text{Bayangan parabola } y = -x^2 - 4x - 3$$

$$\text{adalah } y = x^2 + 4x + 3$$

Jawaban: B.

$$9. (x, y) \xrightarrow{M_{y=\frac{1}{2}}} (x', y')$$

$$\Rightarrow \circ x' = x \Leftrightarrow x = x'$$

$$\circ y' = 2\left(\frac{1}{2}\right) - y \Leftrightarrow y = 1 - y'$$

$$\circ y = x^2 - 3x + 4$$

$$\Leftrightarrow 1 - y' = x'^2 - 3x' + 4$$

$$\Leftrightarrow y' = -x'^2 + 3x' - 3$$

$$\therefore \text{Bayangan parabola } y = x^2 - 3x + 4$$

$$\text{adalah } y = -x^2 + 3x - 3$$

Jawaban: A.

$$10. (x, y) \xrightarrow{M_{y=x}} (x', y')$$

$$\Rightarrow \circ x' = -y \Leftrightarrow y = -x'$$

$$\circ y' = -x \Leftrightarrow x = -y'$$

$$\circ l: y = x^2 - 4x - 8$$

$$\Leftrightarrow -x' = (-y')^2 - 4(-y') - 8$$

$$\Leftrightarrow x' = -y'^2 - 4y' + 8$$

$$\therefore l': x = -y^2 - 4y + 8$$

Jawaban: C.

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Jji Pemahaman Halaman 143

C. Uraian

1. Bayangan untuk

a). $(3, 5) \xrightarrow{M_{x=5}} (2(5)-3, 5) = (7, 5)$

b). $(-2, 7) \xrightarrow{M_{x=-7}} (2(-7)-(-2), 7) = (-12, 7)$

c). $(4, -8) \xrightarrow{M_{y=-12}} (4, 2(-12)-(-8)) = (4, -16)$

d). $(-3, 1) \xrightarrow{M_{y=8}} (-3, 2(8)-1) = (-3, 15)$

e). $(-7, -1) \xrightarrow{M_{x=1\frac{1}{2}}} (2(1\frac{1}{2})-(-7), -1)$
 $= (2(\frac{3}{2})+7, -1)$
 $= (10, -1)$

f). $(-2, 0) \xrightarrow{M_{y=-2\frac{1}{2}}} (-2, 2(-2\frac{1}{2})-0)$
 $= (-2, 2(-\frac{5}{2}))$
 $= (-2, -5)$

2. $\Delta ABC \xrightarrow{M_1 = M_{x=2}} \Delta A_1 B_1 C_1$

$\Delta ABC \xrightarrow{M_2 = M_{y=3}} \Delta A_2 B_2 C_2$

o $A(3, 5); B(1, 0); C(5, 2)$

a). o $A_1(2(2)-3, 5) = A_1(1, 5)$

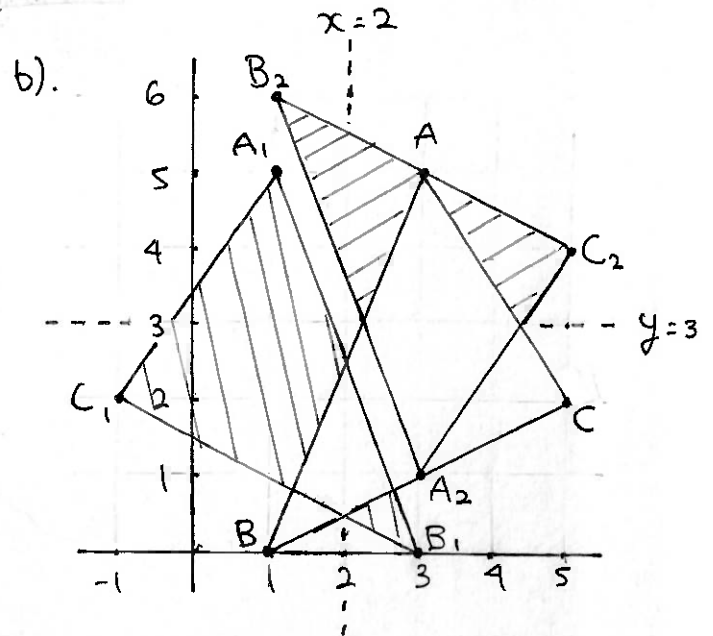
o $B_1(2(2)-1, 0) = B_1(3, 0)$

o $C_1(2(2)-5, 2) = C_1(-1, 2)$

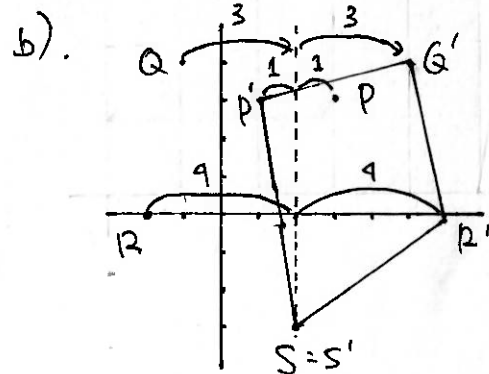
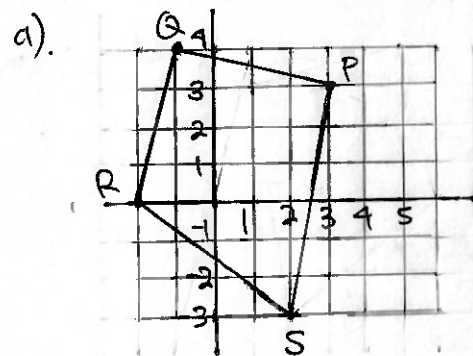
o $A_2(3, 2(3)-5) = A_2(3, 1)$

o $B_2(1, 2(3)-0) = B_2(1, 6)$

o $C_2(5, 2(3)-2) = C_2(5, 4)$



3. $PQRS \xrightarrow{M_{x=2}} P'Q'R'S'$



4. $A(3, 2), B(0, -3), C(-2, 3)$

a). $\Delta ABC \xrightarrow{M_{x=0}} \Delta A' B' C'$

o $A'(2(0)-3, 2) = A'(-3, 2)$

o $B'(2(0)-0, -3) = B'(0, -3)$

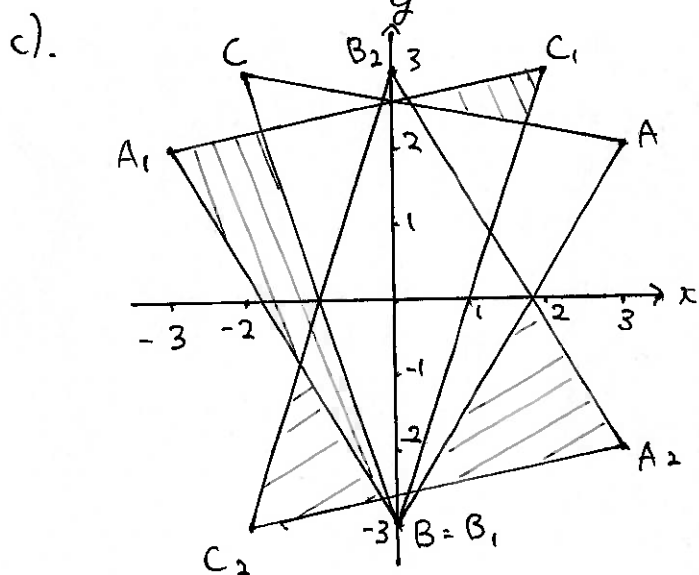
o $C'(2(0)-(-2), 3) = C'(2, 3)$

b). $\triangle ABC \xrightarrow{M_{y=0}} \triangle A_2 B_2 C_2$

◦ $A_2(3, 2(0) - 2) = A_2(3, -2)$

◦ $B_2(0, 2(0) - (-3)) = B_2(0, 3)$

◦ $C_2(-2, 2(0) - 3) = C_2(-2, -3)$



5. $A(1,3), B(3,4), C(2,1)$

a). ◦ $\triangle ABC \xrightarrow{M_x} \triangle A_1 B_1 C_1$

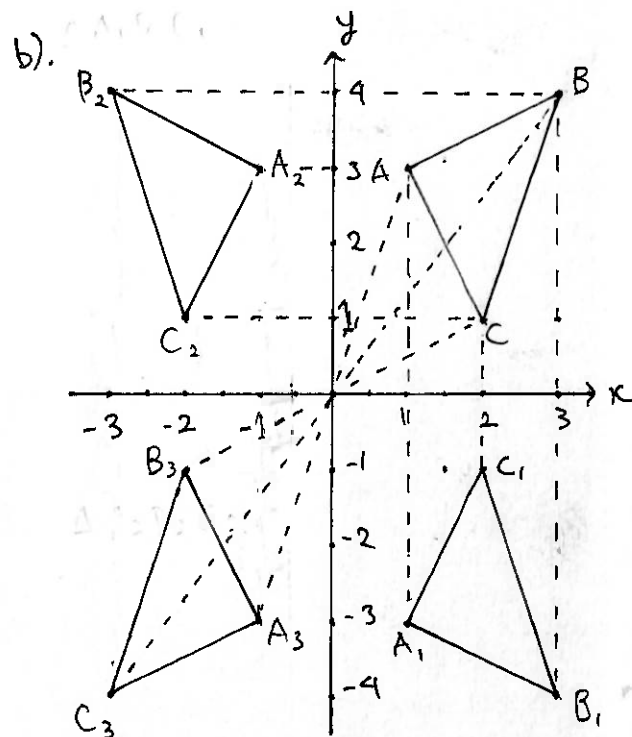
⇒ ◦ $A_1(1, -3); B_1(3, -4); C_1(2, -1)$

◦ $\triangle ABC \xrightarrow{M_y} \triangle A_2 B_2 C_2$

⇒ ◦ $A_2(-1, 3); B_2(-3, 4); C_2(-2, 1)$

◦ $\triangle ABC \xrightarrow{M_{(0,0)}} \triangle A_3 B_3 C_3$

⇒ ◦ $A_3(-1, -3); B_3(-3, -4); C_3(-2, -1)$



6. a). ◦ $(2, 5) \xrightarrow{M_x} (2, -5)$

◦ $(-2, 4) \xrightarrow{M_x} (-2, -4)$

◦ $(-7, 3) \xrightarrow{M_x} (-7, -3)$

◦ $(-1, -6) \xrightarrow{M_x} (-1, -(-6)) = (-1, 6)$

b). ◦ $(2, 5) \xrightarrow{M_y} (-2, 5)$

◦ $(-2, 4) \xrightarrow{M_y} (-(-2), 4) = (2, 4)$

◦ $(-7, 3) \xrightarrow{M_y} (-(-7), 3) = (7, 3)$

◦ $(-1, -6) \xrightarrow{M_y} (-(-1), -6) = (1, -6)$

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7. $A(1,1); B(4,1); C(4,3); D(1,3)$

a). Pencerminan terhadap sumbu x

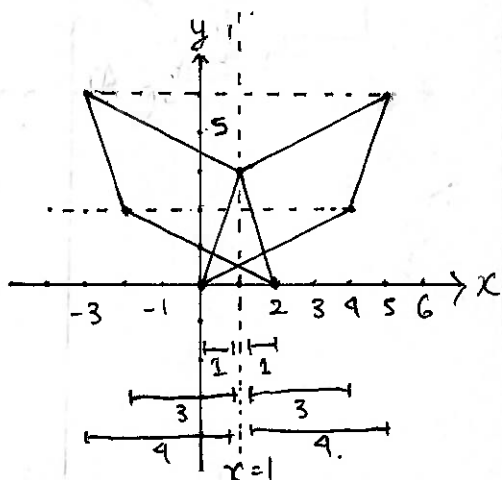
$\Rightarrow ABCD \xrightarrow{M_x} A_1B_1C_1D_1$, dimana
 $A_1(1,-1); B_1(4,-1); C_1(4,-3); D_1(1,-3)$

b). Pencerminan terhadap sumbu y.

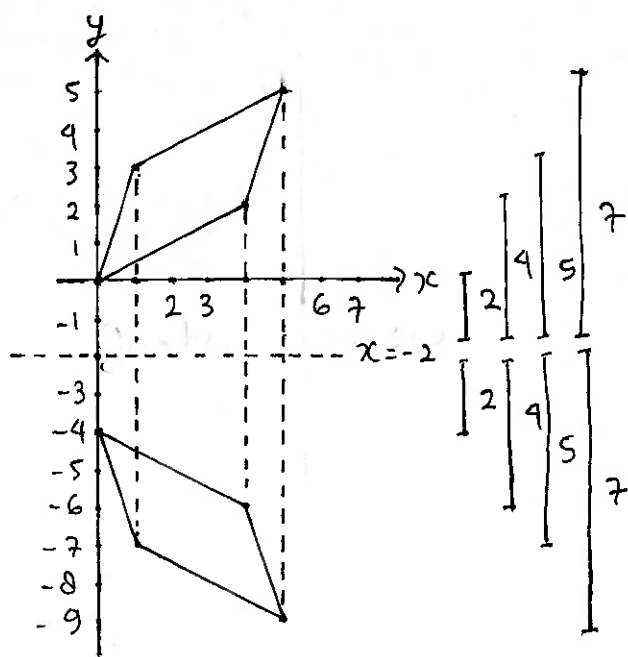
$\Rightarrow ABCD \xrightarrow{M_y} A_2B_2C_2D_2$, dimana
 $A_2(-1,1); B_2(-4,1); C_2(-4,3); D_2(-1,3)$.

8. $A(0,0); B(4,2); C(5,5); D(1,3)$

a). $ABCD \xrightarrow{M_{x=1}} A_1B_1C_1D_1$



b). $ABCD \xrightarrow{M_{y=-2}} A_2B_2C_2D_2$



9. $APQR \xrightarrow{M_{x=5}} A'P'Q'R'$, dimana
 $P(-4,6); Q(-2,-5); R(8,5)$

$\Rightarrow P'(2(5)-(-4), 6) = P'(14,6)$

$\circ Q'(2(5)-(-2), -5) = Q'(12,-5)$

$\circ R'(2(5)-8, 5) = R'(2,5)$

10. $ABCD \xrightarrow{M_{y=2}} A'B'C'D'$, dimana

$A(-6,0); B(-2,-4); C(4,-2); D(6,4)$

$\Rightarrow A'(-6, 2(2)-0) = A'(-6,4)$

$\circ B'(-2, 2(2)-(-4)) = B'(-2,8)$

$\circ C'(4, 2(2)-(-2)) = C'(4,6)$

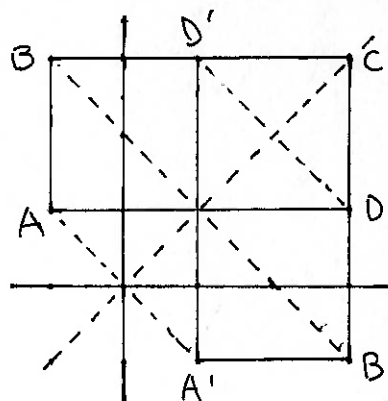
$\circ D'(6, 2(2)-4) = D'(6,0)$.

11. $ABCD \xrightarrow{M_{y=x}} A'B'C'D'$, dimana

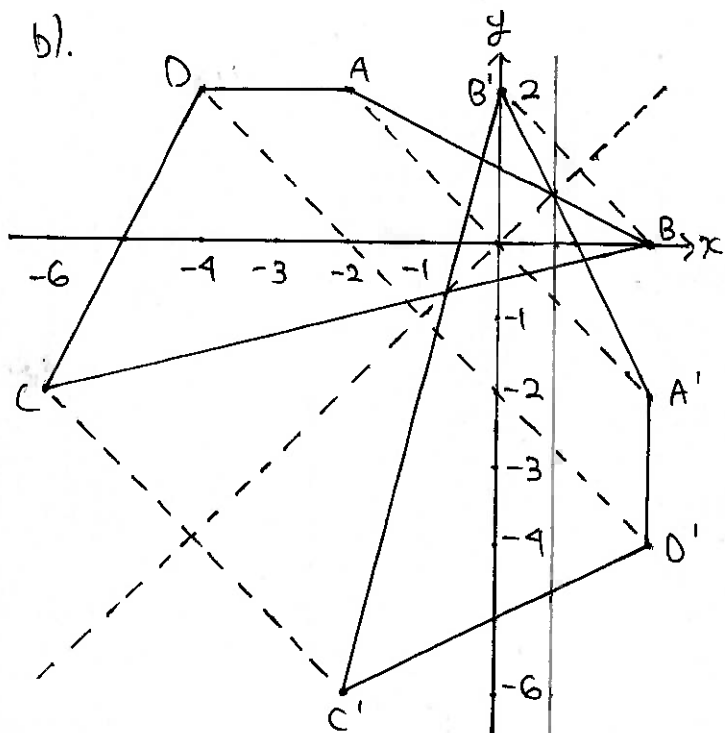
$A(-1,1), B(-1,3), C(3,3), D(3,1)$.

a). $A'(1,-1), B'(3,-1), C(3,3), D(1,3)$

b).



12. $ABCD \xrightarrow{M(y=x)} A'B'C'D'$ dimana
 $A(-2, 2); B(2, 0); C(-6, -2); D(-4, 2)$
 a). $A'(2, -2); B'(0, 2); C(-2, -6); D(2, -4)$



13. Misalkan garis $l \equiv y = x^2 - 8x + 13$

a). $l \equiv y = x^2 - 8x + 13$
 $\equiv y = x^2 - 2 \cdot 4x + 4^2 - 4^2 + 13$
 $\equiv y = (x-4)^2 - 3$
 $\therefore l \equiv y+3 = 1 \cdot (x-4)^2$

- b). (i) Pencerminkan oleh garis $x=1$

$\Rightarrow x' = 2(1) - x \Leftrightarrow x = 2 - x'$
 $\bullet y' = y \Leftrightarrow y = y'$

$\square l \equiv y+3 = (x-4)^2$
 $\Leftrightarrow y'+3 = ((2-x')-4)^2$
 $\Leftrightarrow y'+3 = (-x'-2)^2$
 $\Leftrightarrow y'+3 = (x+2)^2$
 $\therefore l' \equiv y+3 = (x+2)^2$

- (ii) Pencerminkan oleh garis $y=1$

$\Rightarrow x' = x \Leftrightarrow x = x'$
 $\bullet y' = 2(1) - y \Leftrightarrow y = 2 - y'$

$\square l \equiv y+3 = (x-4)^2$
 $\Leftrightarrow (2-y')+3 = (x'-4)^2$
 $\Leftrightarrow 5-y' = (x'-4)^2$
 $\Leftrightarrow y'-5 = -(x'-4)^2$
 $\therefore l' \equiv y-5 = -(x-4)^2$

14. $l \equiv y = 3x + 4$

- \bullet Pencerminkan terhadap garis $x=2$
 $\Rightarrow x' = 2(2) - x \Leftrightarrow x = 4 - x'$ dan $y = y'$

$\square l \equiv y = 3x + 4$
 $\Leftrightarrow y' = 3(4-x') + 4$
 $\Leftrightarrow y' = -3x' + 16$
 $\therefore l' \equiv y = -3x + 16$

15. $g \equiv x + y + 3 = 0$

- a). Pencerminkan terhadap sumbu X
 $\Rightarrow x = x'; y' = -y \Leftrightarrow x = x'; y = -y'$

$\therefore g' \equiv x + (-y) + 3 = 0$
 $\equiv x - y + 3 = 0$

- b). Pencerminkan terhadap sumbu Y
 $\Rightarrow y = y'; x' = -x \Leftrightarrow x = -x'; y = y'$

$\therefore g' \equiv (-x) + y + 3 = 0$
 $\equiv x - y - 3 = 0$

- c). Pencerminkan terhadap garis $y=x$
 $\Rightarrow x = y'$ dan $y = x'$

$\therefore g' \equiv y + x + 3 = 0$

- d). Pencerminkan terhadap garis $y=-x$
 $\Rightarrow x = -y'$ dan $y = x'$

$\therefore g' \equiv (-y') + (-x') + 3 = 0$
 $\equiv x + y - 3 = 0$

A. Memasangkan

1. $A(3, -7) \xrightarrow{R(0; 270^\circ)} A'(x', y')$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 270^\circ & -\sin 270^\circ \\ \sin 270^\circ & \cos 270^\circ \end{pmatrix} \begin{pmatrix} 3 \\ -7 \end{pmatrix}$$

$$= \begin{pmatrix} 3 \cdot \cos 270^\circ + 7 \cdot \sin 270^\circ \\ 3 \cdot \sin 270^\circ - 7 \cdot \cos 270^\circ \end{pmatrix}$$

$$\Rightarrow x' = 3 \cdot 0 + 7(-1) = -7$$

$$y' = 3(-1) - 7(0) = -3 \Rightarrow A'(-7, -3)$$

Jawaban: E

2. $A(4, -1) \xrightarrow{R(0; 90^\circ)} (x', y')$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} -4 \\ -1 \end{pmatrix}$$

$$= \begin{pmatrix} (-4) \cdot \cos 90^\circ + \sin 90^\circ \\ (-4) \cdot \sin 90^\circ - \cos 90^\circ \end{pmatrix}$$

$$\Rightarrow x' = (-4)(0) + 1 = 1$$

$$y' = (-4)(1) - 0 = -4 \Rightarrow$$

\therefore Bayangan $(-4, -1)$ oleh $R(0; 90^\circ)$ adalah $(1, -4)$

Jawaban: B

3. $\circ \cos(-90^\circ) = \cos 90^\circ = 0$

$\circ \sin(-90^\circ) = -\sin 90^\circ = -1$

$(5, -4) \xrightarrow{R((3, -1); -90^\circ)} (x', y')$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos(-90^\circ) & -\sin(-90^\circ) \\ \sin(-90^\circ) & \cos(-90^\circ) \end{pmatrix} \begin{pmatrix} 5-3 \\ -4-(-1) \end{pmatrix}$$

$$+ \begin{pmatrix} 3 \\ -1 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 2 \\ -3 \end{pmatrix} + \begin{pmatrix} 3 \\ -1 \end{pmatrix}$$

$$\Rightarrow x' = 0 \cdot 2 + 1 \cdot (-3) + 3 = 0$$

$$y' = (-1) \cdot 2 + 0 \cdot (-3) + (-1) = -3$$

(11)

\therefore Bayangan $(5, -4)$ oleh $R((3, -1), -90^\circ)$ adalah $(0, -3)$

Jawaban: C

4. Titik potong garis $x+2y=4$ dan garis $4x+3y=16$ adalah $A(x, y)$

$$\Rightarrow x+2y=4 \Leftrightarrow 3x+6y=12$$

$$4x+3y=16 \Leftrightarrow \frac{8x+6y=32}{-5x=-20}$$

$$\Leftrightarrow x=4$$

$$\circ x+2y=4 \Rightarrow 2y=4-x=4-4=0$$

$$\Leftrightarrow y=0$$

$\therefore A(4, 0)$

$\circ A(4, 0) \xrightarrow{R((1, 2), 90^\circ)} A'(x', y')$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} 4-1 \\ 0-2 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 3 \\ -2 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \end{pmatrix}$$

$$\Rightarrow x' = 0 \cdot 3 + (-1) \cdot (-2) + 1 = 3$$

$$y' = 1 \cdot 3 + 0 \cdot (-2) + 2 = 5 \Rightarrow A'(3, 5)$$

Jawaban: D

5. Parabola $y=x^2+6x+16 = x^2+2 \cdot 3x+16$

$$\Leftrightarrow y = x^2 + 2 \cdot 3x + 3^2 - 3^2 + 16$$

$$\Leftrightarrow y + 3^2 - 16 = (x + 3)^2$$

$$\Leftrightarrow y - 7 = (x - (-3))^2$$

\therefore Titik balik parabola di atas $= (-3, 7)$

$(-3, 7) \xrightarrow{R(0; 180^\circ)} (x', y')$

$$\Rightarrow x' = -3 \cdot \cos 180^\circ + 7 \cdot \sin 180^\circ = 3$$

$$y' = -3 \cdot \sin 180^\circ + 7 \cdot \cos 180^\circ = -7$$

\therefore Bayangan titik balik parabola di atas oleh $R(0; 180^\circ)$ adalah $(3, -7)$

Jawaban: A.

B. Pilihan Ganda

1. $A(\sqrt{3}, 1) \xrightarrow{R(0; 60^\circ)} A'(x', y')$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 60^\circ & -\sin 60^\circ \\ \sin 60^\circ & \cos 60^\circ \end{pmatrix} \begin{pmatrix} \sqrt{3} \\ 1 \end{pmatrix}$$

$$= \begin{pmatrix} \frac{1}{2} & -\frac{1}{2}\sqrt{3} \\ \frac{1}{2}\sqrt{3} & \frac{1}{2} \end{pmatrix} \begin{pmatrix} \sqrt{3} \\ 1 \end{pmatrix}$$

$$\Rightarrow x' = \frac{1}{2}\sqrt{3} - \frac{1}{2}\sqrt{3} \cdot 1 = 0$$

$$y' = \frac{1}{2}\sqrt{3} \cdot \sqrt{3} + \frac{1}{2} = \frac{3}{2} + \frac{1}{2} = 2 \Rightarrow A'(0, 2)$$

Jawaban: A.

2. $A(x, y) \xrightarrow{R(0; -90^\circ)} A'(-10, -2)$

$$\begin{pmatrix} -10 \\ -2 \end{pmatrix} = \begin{pmatrix} \cos(-90^\circ) & -\sin(-90^\circ) \\ \sin(-90^\circ) & \cos(-90^\circ) \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\Rightarrow 0 - 10 = x \cdot \cos(-90^\circ) - y \cdot \sin(-90^\circ) = y$$

$$0 - 2 = x \cdot \sin(-90^\circ) + y \cdot \cos(-90^\circ) = -x$$

$$\Rightarrow x + 2y = -(-x) + 2(y) = -(2) + 2(-10) = -18$$

Jawaban: C.

3. $(x, y) \xrightarrow{R((3, 1); 90^\circ)} (x', y')$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} x-3 \\ y-1 \end{pmatrix} + \begin{pmatrix} 3 \\ 1 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x-3 \\ y-1 \end{pmatrix} + \begin{pmatrix} 3 \\ 1 \end{pmatrix}$$

$$\Rightarrow 0 \cdot x' = -(y-1) + 3 \Leftrightarrow y = 4 - x'$$

$$\Rightarrow y' = (x-3) + 1 \Leftrightarrow x = y' + 2$$

\Rightarrow Bayangan garis $y = 3x + 7$ adalah.

$$(4 - x) = 3(y + 2) + 7$$

$$\Leftrightarrow 4 - x = 3y + 13$$

$$\Leftrightarrow x + 3y + 9 = 0$$

Jawaban: D.

4. $(x, y) \xrightarrow{R((3, -4); -180^\circ)} (x', y')$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos(-180^\circ) & -\sin(-180^\circ) \\ \sin(-180^\circ) & \cos(-180^\circ) \end{pmatrix} \begin{pmatrix} x-3 \\ y+4 \end{pmatrix} + \begin{pmatrix} 3 \\ -4 \end{pmatrix}$$

$$= \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} x-3 \\ y+4 \end{pmatrix} + \begin{pmatrix} 3 \\ -4 \end{pmatrix}$$

$$\Rightarrow x' = -(x-3) + 3 \Leftrightarrow x = 6 - x'$$

$$\Rightarrow y' = -(y+4) - 4 \Leftrightarrow y = -y' - 8$$

\therefore Bayangan garis $y = -x + 3$ adalah garis

$$(-y - 8) = -(6 - x) + 3$$

$$\Leftrightarrow -y - 8 = x - 3$$

$$\Leftrightarrow y = -x - 5$$

Jawaban: C.

5. Garis $l \equiv y = \sqrt{2}x + \sqrt{2}$ dirotasi oleh $R(0; 45^\circ)$ menghasilkan garis l'

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 45^\circ & -\sin 45^\circ \\ \sin 45^\circ & \cos 45^\circ \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\Rightarrow x' = \frac{1}{2}\sqrt{2}x - \frac{1}{2}\sqrt{2}y$$

$$y' = \frac{1}{2}\sqrt{2}x + \frac{1}{2}\sqrt{2}y +$$

$$x' + y' = \sqrt{2}x \Leftrightarrow x = \frac{1}{2}\sqrt{2}(x' + y')$$

$$\Rightarrow x' = \frac{1}{2}\sqrt{2}x - \frac{1}{2}\sqrt{2}y$$

$$y' = \frac{1}{2}\sqrt{2}x + \frac{1}{2}\sqrt{2}y -$$

$$x' - y' = -\sqrt{2}y \Leftrightarrow y = \frac{1}{2}\sqrt{2}(y' - x')$$

\therefore garis l' memiliki bentuk persamaan

$$\Rightarrow \left(\frac{1}{2}\sqrt{2}(y' - x')\right) = \sqrt{2} \cdot \left(\frac{1}{2}\sqrt{2}(x + y)\right) + \sqrt{2}$$

$$\Leftrightarrow \frac{1}{2}\sqrt{2}y' - \frac{1}{2}\sqrt{2}x' = x + y + \sqrt{2}$$

$$\Leftrightarrow \sqrt{2}y' - \sqrt{2}x' = 2x + 2y + 2\sqrt{2}$$

$$\Leftrightarrow (2 - \sqrt{2})y' = -(2 + \sqrt{2})x' - 2\sqrt{2}$$

$$\Leftrightarrow y' = \frac{-(2 + \sqrt{2})}{2 - \sqrt{2}}x' - \frac{2\sqrt{2}}{2 - \sqrt{2}}$$

$$= -\frac{(2 + \sqrt{2})^2}{2}x' - \frac{2 \cdot \sqrt{2} \cdot (2 + \sqrt{2})}{2}$$

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$$\rightarrow l' \equiv y = -\frac{4+2\sqrt{2}+2}{2}x - (2+2\sqrt{2})$$

$$\Leftrightarrow y = -(3+\sqrt{2})x - (2+2\sqrt{2})$$

Jawaban: B.

$$6. (x, y) \xrightarrow{R((3,0); 90^\circ)} (x', y')$$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} x-3 \\ y \end{pmatrix} + \begin{pmatrix} 3 \\ 0 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x-3 \\ y \end{pmatrix} + \begin{pmatrix} 3 \\ 0 \end{pmatrix}$$

$$\Rightarrow x' = -y + 3 \Leftrightarrow y = 3 - x'$$

$$y' = x - 3 + 0 \Leftrightarrow x = y' + 3$$

\therefore Bayangan garis $x = -y$ oleh $R(0; 90^\circ)$

$$\equiv (y' + 3) = -(3 - x') \Leftrightarrow -x' + y' + 6 = 0$$

Jawaban: B

$$7. (x, y) \xrightarrow{R((2,3); 180^\circ)} (x', y')$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 180^\circ & -\sin 180^\circ \\ \sin 180^\circ & \cos 180^\circ \end{pmatrix} \begin{pmatrix} x-2 \\ y-3 \end{pmatrix} + \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

$$= \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} x-2 \\ y-3 \end{pmatrix} + \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

$$\Rightarrow x' = -(x-2) + 2 \Leftrightarrow x = 4 - x'$$

$$\Rightarrow y' = -(y-3) + 3 \Leftrightarrow y = 6 - y'$$

$$\square \text{ garis } l \equiv y = x^2 - 4x + 7.$$

$$\Leftrightarrow y - 3 = x^2 - 4x + 4$$

$$\Leftrightarrow y - 3 = (x - 2)^2.$$

\therefore Bayangan garis l oleh $R((2,3), 180^\circ)$

$$\equiv (6 - y') - 3 = ((4 - x') - 2)^2$$

$$\Leftrightarrow 3 - y' = (2 - x')^2$$

$$\Leftrightarrow 3 - y' = x'^2 - 4x' + 4$$

$$\Leftrightarrow y' = -x'^2 + 4x' - 1$$

Jawaban: D.

$$8. \text{ misalkan } l \equiv y = x^2 + 3$$

Jadi bayangan garis l oleh

$R(0; 90^\circ)$ adalah l' dimana $(x', y') \in l'$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -y \\ x \end{pmatrix}$$

$$\Rightarrow x' = -y \Leftrightarrow y = -x' \text{ dan}$$

$$y' = x \Leftrightarrow x = y'$$

$$\Rightarrow l' \equiv (-x) = (y')^2 + 3 \equiv x = -y'^2 - 3.$$

Jawaban: D

$$9. (x, y) \xrightarrow{R((10,0); -270^\circ)} (x', y')$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos(-270^\circ) & -\sin(-270^\circ) \\ \sin(-270^\circ) & \cos(-270^\circ) \end{pmatrix} \begin{pmatrix} x-10 \\ y \end{pmatrix} + \begin{pmatrix} 10 \\ 0 \end{pmatrix}$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x-10 \\ y \end{pmatrix} + \begin{pmatrix} 10 \\ 0 \end{pmatrix}$$

$$\Rightarrow x' = -y + 10$$

$$\Rightarrow y' = x - 10 + 0 = x - 10$$

akarena titik puncak

$$y = x^2 - 4x - 5$$

$$\text{adalah } \left(-\frac{-4}{2}, -\frac{(-4)^2 - 4 \cdot 1 \cdot (-5)}{4} \right) = (2, -9).$$

maka titik puncak dari bayangan

parabola $y = x^2 - 4x - 5$ adalah.

$$(-(-9) + 10, 2 - 10) = (19, -8)$$

Jawaban: E.

$$10. \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} y \\ x \end{pmatrix} = \begin{pmatrix} -x \\ y \end{pmatrix}$$

$$\Rightarrow x' = -x \Leftrightarrow x = -x' \text{ dan } y = y'$$

\therefore Bayangan dari $3x - y = -2$ oleh $M_y = x$

(atau $R(0; 90^\circ)$) adalah

$$3(-x) - y = -2 \Leftrightarrow 3x + y - 2 = 0$$

Jawaban: B.

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C. Uraian

1. a). $(x, y) \xrightarrow{R_{90^\circ}} (x_1, y_1)$

$$\begin{pmatrix} x_1 \\ y_1 \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \\ = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -y \\ x \end{pmatrix}$$

$\therefore x_1 = -y$ dan $y_1 = x$.

° $A(4, 7) \xrightarrow{R_{90^\circ}} A_1(-7, 4)$

° $B(-1, 2) \xrightarrow{R_{90^\circ}} B_1(-2, -1)$

° $C(5, -3) \xrightarrow{R_{90^\circ}} C_1(3, 5)$

° $D(5, 3) \xrightarrow{R_{90^\circ}} D_1(-3, 5)$

b). $(x, y) \xrightarrow{R_{180^\circ}} (x_2, y_2)$

$$\begin{pmatrix} x_2 \\ y_2 \end{pmatrix} = \begin{pmatrix} \cos 180^\circ & -\sin 180^\circ \\ \sin 180^\circ & \cos 180^\circ \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \\ = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -x \\ -y \end{pmatrix}$$

$\therefore x_2 = -x$ dan $y_2 = -y$

$\Rightarrow A_2(-4, -7), B_2(1, -2), C_2(-5, 3)$ dan $D_2(-5, -3)$.

c). karena

$$(x, y) \xrightarrow{R_{270^\circ}} (x_3, y_3)$$

$$= (x, y) \xrightarrow{R_{90^\circ}} (x_1, y_1) \xrightarrow{R_{180^\circ}} (x_3, y_3)$$

$\Rightarrow x_3 = -x_1 = -(-y) = y$, dan

$y_3 = -y_1 = -x$

$\Rightarrow A_3(7, -4); B_3(2, 1); C_3(-3, -5)$, dan $D_3(3, -5)$.

2. a). $\triangle ABC \xrightarrow{R_{90^\circ}} \triangle A_1 B_1 C_1$

$$\begin{pmatrix} x_1 \\ y_1 \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$\Rightarrow x_1 = -y$ dan $y_1 = x$.

\therefore Bayangan $\triangle ABC$ adalah $\triangle A_1 B_1 C_1$ dengan A_1

° $A_1(-2, 1), B_1(-2, -4), C_1(-6, 2)$.

b). $\triangle ABC \xrightarrow{R_{-90^\circ}} \triangle A_2 B_2 C_2$

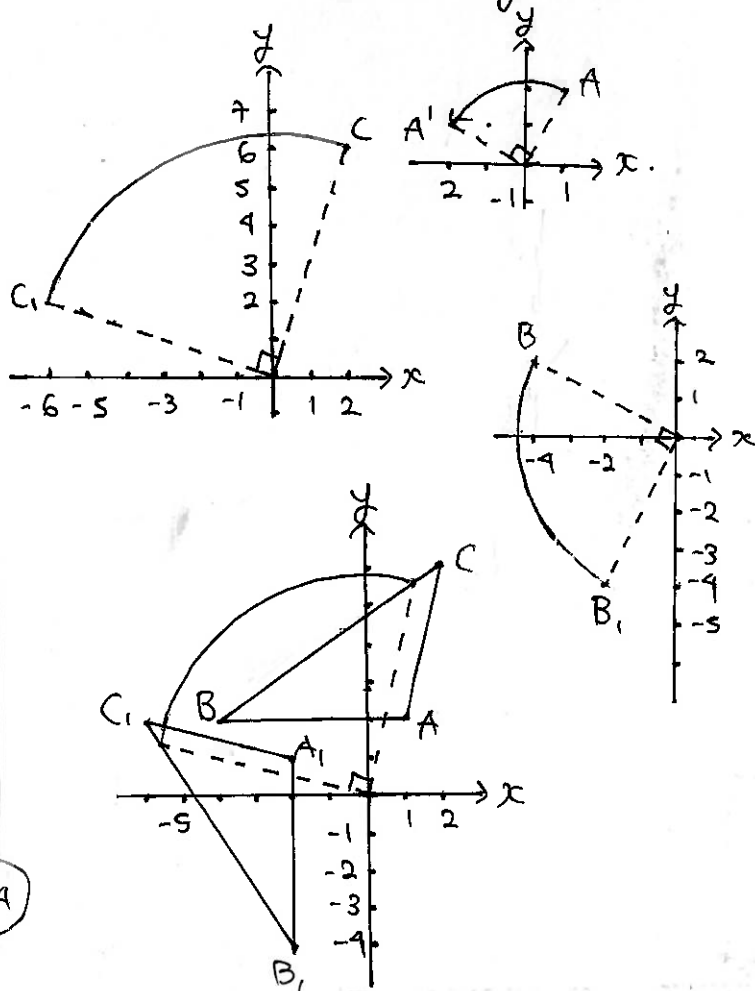
$$\begin{pmatrix} x_2 \\ y_2 \end{pmatrix} = \begin{pmatrix} \cos(-90^\circ) & -\sin(-90^\circ) \\ \sin(-90^\circ) & \cos(-90^\circ) \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \\ = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$\Rightarrow x_2 = y$ dan $y_2 = -x$.

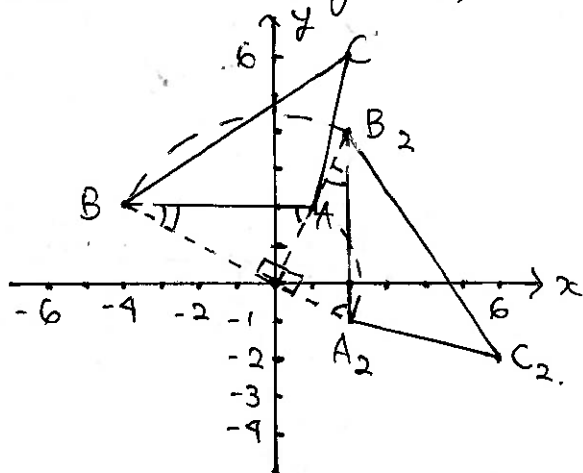
\therefore Bayangan $\triangle ABC$ oleh R_{-90° adalah $\triangle A_2 B_2 C_2$ dengan

$A_2(2, -1), B_2(2, 4), C_2(6, -2)$.

* Gambar Untuk Bagian a). *



* Gambar untuk bagian b).*



3. Misalkan titik yang diketahui disebut titik A dan bayangannya adalah titik $A'(x', y')$

a). $A(5, 4) \xrightarrow{R((1, 2); 90^\circ)} A'(x', y')$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} 5-1 \\ 4-2 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 4 \\ 2 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \begin{pmatrix} -1 \\ 6 \end{pmatrix}$$

$\therefore A'(-1, 6)$

b). $A(-2, 3) \xrightarrow{R((2, -1); 180^\circ)} A'(x', y')$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 180^\circ & -\sin 180^\circ \\ \sin 180^\circ & \cos 180^\circ \end{pmatrix} \begin{pmatrix} -2-2 \\ 3-(-1) \end{pmatrix} + \begin{pmatrix} 2 \\ -1 \end{pmatrix}$$

$$= \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} -4 \\ 4 \end{pmatrix} + \begin{pmatrix} 2 \\ -1 \end{pmatrix} = \begin{pmatrix} 6 \\ -3 \end{pmatrix}$$

$\therefore A'(6, -3)$

c). $A(0, 0) \xrightarrow{R((-4, -2); 270^\circ)} A'(x', y')$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 270^\circ & -\sin 270^\circ \\ \sin 270^\circ & \cos 270^\circ \end{pmatrix} \begin{pmatrix} 0+4 \\ 0+2 \end{pmatrix} + \begin{pmatrix} -4 \\ -2 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 4 \\ 2 \end{pmatrix} + \begin{pmatrix} -4 \\ -2 \end{pmatrix} = \begin{pmatrix} -2 \\ -6 \end{pmatrix}$$

$\therefore A'(-2, -6)$

d). $A(4, -1) \xrightarrow{R((1, 1); 90^\circ)} A'(x', y')$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} 4-1 \\ -1-1 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 3 \\ -2 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$$

$\therefore A'(3, 4)$

e). $A(-1, 2) \xrightarrow{R((0, -3); 270^\circ)} A'(x', y')$

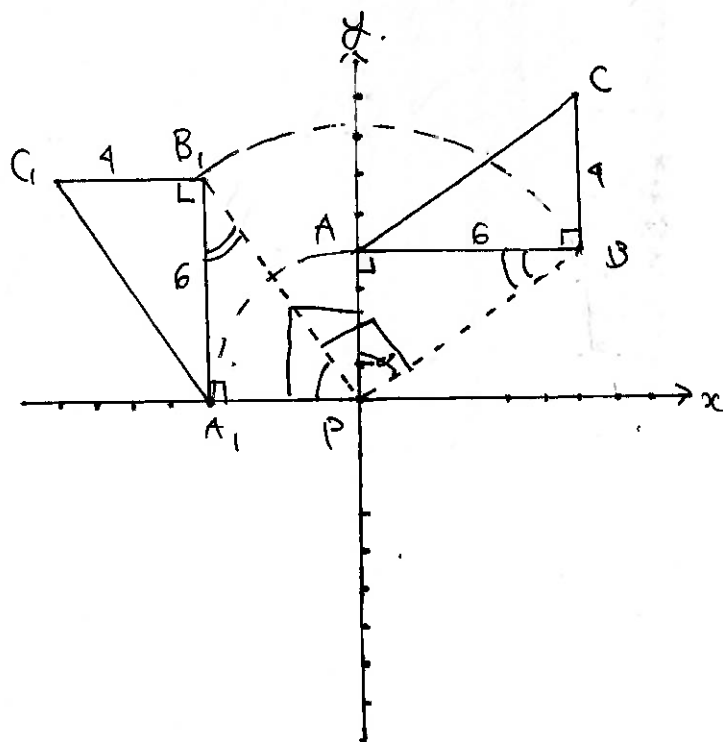
$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 270^\circ & -\sin 270^\circ \\ \sin 270^\circ & \cos 270^\circ \end{pmatrix} \begin{pmatrix} -1-0 \\ 2+3 \end{pmatrix} + \begin{pmatrix} 0 \\ -3 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} -1 \\ 5 \end{pmatrix} + \begin{pmatrix} 0 \\ -3 \end{pmatrix} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$$

$\therefore A'(5, -2)$

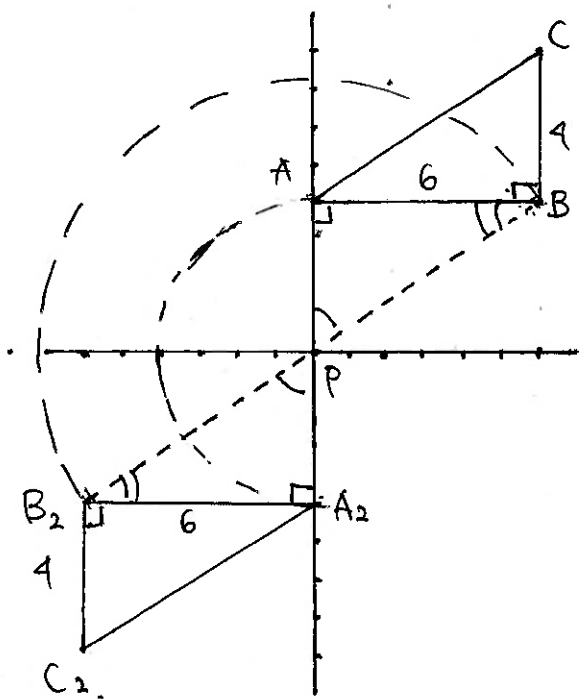
4. Misalkan Padahal titik $(0, 0)$ dimana segmen PA berada di sumbu Y dengan panjang x .

a). Berotasi 90°



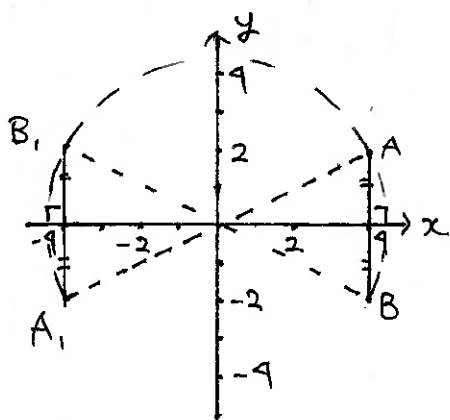
Uji Pemahaman Halaman 151

b). Berotasi sebesar 180°

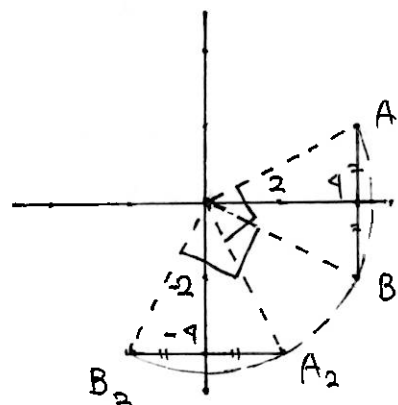


5. Pusat rotasi = $O(0,0)$

a). Sudut putar 180°



o Sudut putar -90°



b). Berdasarkan gambar

$A, B \in x = -4$, dan $A_2, B_2 \in y = -4$ (16)

6. $A(2,1); B(3,3)$

$$a) \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 270^\circ & -\sin 270^\circ \\ \sin 270^\circ & \cos 270^\circ \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \\ = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} y \\ -x \end{pmatrix}$$

• karena $AB \xrightarrow{R(0, 270^\circ)} A_1, B_1$

$\Rightarrow A_1 = (1, -2)$ dan $B_1 = (3, -3)$

$$b) \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos(-180^\circ) & -\sin(-180^\circ) \\ \sin(-180^\circ) & \cos(-180^\circ) \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \\ = \begin{pmatrix} \cos 180^\circ & \sin 180^\circ \\ -\sin 180^\circ & \cos 180^\circ \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \\ = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -x \\ -y \end{pmatrix}$$

• karena $AB \xrightarrow{R(0, -180^\circ)} A_2, B_2$

$\Rightarrow A_2 = (-2, -1)$ dan $B_2 = (-3, -3)$

7. a). Berdasarkan gambar

$P'(-3, -6); Q'(-5, -4); R'(-3, -2)$

b). Transformasi lain yang sesuai adalah pencerminan terhadap garis :

o $x = -1$ dan

o $y = -2$.

atau titik $(-1, -2)$.

$$P'(-3, -6) = (2(-1) - 1, 2(-2) - 2)$$

$$Q'(-5, -4) = (2(-1) - 3, 2(-2) - 0)$$

$$R'(-3, -2) = (2(-1) - 1, 2(-2) - (-2))$$

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8. misalkan $P = (a, b)$

$$\Rightarrow \Delta ABC \xrightarrow{R((a,b); \theta)} \Delta A'B'C'$$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} x-a \\ y-b \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix}$$

$$\Rightarrow x' = (x-a) \cdot \cos \theta - (y-b) \cdot \sin \theta + a$$

$$y' = (x-a) \cdot \sin \theta + (y-b) \cdot \cos \theta + b$$

$$\square A(-4, 2) \xrightarrow{R(P; \theta)} A'(-1, -1).$$

$$\Rightarrow -1 = (-4-a) \cdot \cos \theta - (2-b) \cdot \sin \theta + a$$

... Pers.(1).

$$0-1 = (-4-a) \cdot \sin \theta + (2-b) \cos \theta + b$$

.... Pers.(2).

$$\square B(-1, 2) \xrightarrow{R(P; \theta)} B'(-1, -4).$$

$$\Rightarrow -1 = (-1-a) \cdot \cos \theta - (2-b) \cdot \sin \theta + a$$

... Pers.(3).

$$0-4 = (-1-a) \cdot \sin \theta + (2-b) \cos \theta + b.$$

... Pers.(4).

$$\Delta \text{ Pers (2) - Pers (4)}$$

$$\Rightarrow -1 - (-3) = (-4-a) \sin \theta - (-1-a) \sin \theta.$$

$$\Leftrightarrow 3 = -4 \sin \theta - \cancel{a \sin \theta} + \sin \theta + \cancel{a \sin \theta}$$

$$\Leftrightarrow 3 = -3 \sin \theta$$

$$\Leftrightarrow \sin \theta = -1$$

$$\Leftrightarrow \theta = 270^\circ$$

$$\Delta \text{ Pers (1)} \Rightarrow -1 = -(2-b) \cdot (-1) + a.$$

$$\Leftrightarrow -1 = 2-b+a$$

$$\Leftrightarrow a-b = -3 \dots \text{Pers (5)}$$

$$\Delta \text{ Pers (2)} \Rightarrow -1 = (-4-a) \cdot (-1) + b$$

$$\Leftrightarrow -1 = 4+a+b$$

$$\Leftrightarrow a+b = -5 \dots \text{Pers (6)} \quad \Leftrightarrow 2a = 10 \Leftrightarrow a = 5.$$

$$\Rightarrow \text{Pers (5)} \Rightarrow a-b = -3$$

$$\Rightarrow \text{Pers (6)} \Rightarrow \frac{a+b = -5}{2a = -8 \Leftrightarrow a = -4}.$$

$$\Rightarrow \text{Pers (5) dan } a = -4$$

$$\Rightarrow a-b = -3 \Leftrightarrow b = a+3 = -4+3 = -1$$

$$\therefore P(-4, 1)$$

$$a) P(-4, 1)$$

$$b). \theta = 270^\circ \text{ berlawanan arah jarum jam}$$

9. misalkan $H = (a, b)$ dan

besarsudut rotasi = θ

$$\square A(2, 3) \xrightarrow{R(H; \theta)} A'(8, 3)$$

$$\Rightarrow 8 = (2-a) \cdot \cos \theta - (3-b) \cdot \sin \theta + a \dots (1)$$

$$0-3 = (2-a) \sin \theta + (3-b) \cos \theta + b \dots (2)$$

$$\square B(5, 6) \xrightarrow{R(H; \theta)} B'(5, 0)$$

$$\Rightarrow 5 = (5-a) \cos \theta - (6-b) \sin \theta + a \dots (3)$$

$$0-0 = (5-a) \sin \theta + (6-b) \cos \theta + b \dots (4)$$

$$\Delta \text{ Pers (2) - Pers (4)}$$

$$\Rightarrow 3-0 = (2-5) \sin \theta + (3-6) \cos \theta$$

$$\Leftrightarrow 3 = -3 \sin \theta - 3 \cos \theta \dots (5)$$

$$\Delta \text{ Pers (1) - Pers (3)}$$

$$\Rightarrow 8-5 = (2-5) \cos \theta - (3-6) \sin \theta$$

$$\Leftrightarrow 3 = -3 \cos \theta + 3 \sin \theta \dots (6)$$

$$\text{Pers (5)} \Rightarrow 3 = -3 \cos \theta - 3 \sin \theta +$$

$$6 = -6 \cos \theta$$

$$\Rightarrow \cos \theta = -1 \Leftrightarrow \theta = 180^\circ$$

$$\text{Pers (1) \& } \theta = 180^\circ$$

$$\Rightarrow 8 = (2-a) \cdot (-1) + a$$

$$(17) \Leftrightarrow 8 = -2 + 2a$$

$$\Leftrightarrow 2a = 10 \Leftrightarrow a = 5.$$

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Pers (2) & $\theta = 180^\circ$

$$\Rightarrow 3 = (3-b) \cdot (-1) + b$$

$$\Leftrightarrow 3 = -3 + 2b \Leftrightarrow 2b = 6 \Leftrightarrow b = 3.$$

a). $H(5, 3)$

b). $\theta = 180^\circ$ berlawanan arah arum jam

10. Misalkan $P = (a, b)$; sudut rotasi = θ

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} x-a \\ y-b \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix}$$

$$\Rightarrow x' = (x-a)\cos\theta - (y-b)\sin\theta + a$$

$$y' = (x-a)\sin\theta + (y-b)\cos\theta + b.$$

• $A(5, -1\frac{1}{2}) \xrightarrow{R((a,b);\theta)} A'(1\frac{1}{2}, 3)$

$$\Rightarrow 1\frac{1}{2} = (5-a)\cos\theta - (-1\frac{1}{2}-b)\sin\theta + a$$

... Pers (1)

$$\bullet 3 = (5-a)\sin\theta + (-1\frac{1}{2}-b)\cos\theta + b$$

... Pers (2)

• $B(-1, -3) \xrightarrow{R((a,b);\theta)} B'(3, -3)$

$$\Rightarrow 3 = (-1-a)\cos\theta - (-3-b)\sin\theta + a$$

... Pers (3)

$$\bullet -3 = (-1-a)\sin\theta + (-3-b)\cos\theta + b$$

... Pers (4)

A Pers (1) - Pers (3)

$$\Rightarrow 1\frac{1}{2} - 3 = (5 - (-1))\cos\theta - (-1\frac{1}{2} - (-3))\sin\theta$$

$$\Leftrightarrow -\frac{3}{2} = 6\cos\theta - \frac{3}{2}\sin\theta \dots \text{Pers (5)}$$

A Pers (2) - Pers (4)

$$\Rightarrow 3 - (-3) = (5 - (-1))\sin\theta + (-1\frac{1}{2} - (-3))\cos\theta$$

$$\Leftrightarrow 6 = 6\sin\theta + \frac{3}{2}\cos\theta \dots \text{Pers (6)}$$

Pers (5) $\times 4 \Leftrightarrow -6 = 24\cos\theta - 6\sin\theta$

Pers (6) $\times 1 \Leftrightarrow 6 = 6\sin\theta + \frac{3}{2}\cos\theta$

$$0 = (24 + \frac{3}{2})\cos\theta$$

$$\Leftrightarrow \cos\theta = 0$$

• Pers (6) & $\cos\theta = 0$

$$\Rightarrow 6 = 6\sin\theta \Leftrightarrow \sin\theta = 1 \Leftrightarrow \theta = 90^\circ$$

• Pers (1) & $\cos\theta = 0, \sin\theta = 1$.

$$\Rightarrow 1\frac{1}{2} = -(-1\frac{1}{2}-b) + a \Leftrightarrow a+b=3 \dots (7)$$

• Pers (2), $\cos\theta = 0, \sin\theta = 1$

$$\Rightarrow 3 = 5 - a + b \Leftrightarrow a - b = 2.$$

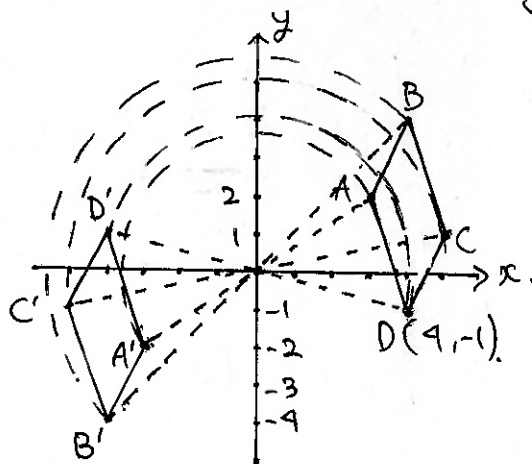
Pers (7) $\Rightarrow \frac{a+b=3}{2a=5} \Leftrightarrow a = \frac{5}{2} = 2,5.$

$$\Rightarrow a-b=2 \Leftrightarrow b = a-2 = 2,5-2 = 0,5$$

a). $P(2,5; 0,5) = P(2\frac{1}{2}, \frac{1}{2})$

b). $\theta = 90^\circ$ berlawanan arah arum jam.

11.



• Karena ABCD adalah jajargenjang

CD merupakan hasil suatu translasi dari BA

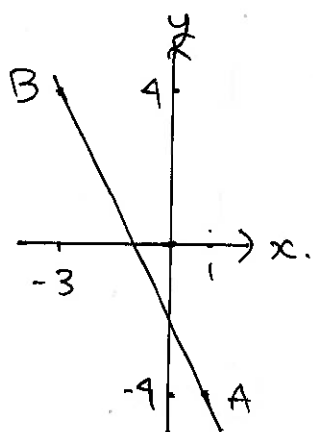
$$\Rightarrow T = \begin{pmatrix} 5 \\ 1 \end{pmatrix} - \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 4 \\ 0 \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} m \\ n \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} + \begin{pmatrix} 1 \\ -3 \end{pmatrix} = \begin{pmatrix} 4 \\ -1 \end{pmatrix} \Rightarrow D(4, -1).$$

karena $ABCD \xrightarrow{R_{180^\circ}} A'B'C'D'$

$$\Rightarrow A'(-3, -2); B'(-4, -4); C'(-5, -1); D'(-4, 1)$$

12.



$$\therefore \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} x - 0 \\ y + 2 \end{pmatrix} + \begin{pmatrix} 0 \\ -2 \end{pmatrix}$$

$$\Rightarrow x' = x \cos \theta - (y + 2) \sin \theta$$

$$y' = x \sin \theta + (y + 2) \cos \theta - 2.$$

a) $A(1, -4) \xrightarrow{R((0, -2); -90^\circ)} A'(x', y')$

$$\Rightarrow A' = (1 \cdot \cos(-90^\circ) - (-2) \sin(-90^\circ), \\ 1 \cdot \sin(-90^\circ) + (-2) \cos(-90^\circ) - 2) \\ = (1 \cdot 0 + 2 \cdot (-1), 1 \cdot (-1) + (-2) \cdot 0 - 2)$$

$$\therefore A' = (-2, -3).$$

$B(-3, 4) \xrightarrow{R((0, -2); -90^\circ)} B'(x', y')$

$$\Rightarrow B' = ((-3) \cdot \cos(-90^\circ) - 6 \cdot \sin(-90^\circ), \\ (-3) \cdot \sin(-90^\circ) + 6 \cdot \cos(-90^\circ) - 2) \\ = ((-3) \cdot 0 - 6 \cdot (-1), (-3) \cdot (-1) + 6 \cdot 0 - 2)$$

$$\therefore B' = (6, 1)$$

\therefore Persamaan garis $A'B'$:

$$= \frac{y - 1}{-3 - 1} = \frac{x - 6}{-2 - 6}$$

$$\Leftrightarrow \frac{y - 1}{-4} = \frac{x - 6}{-8}$$

$$\Leftrightarrow (y - 1) \times 2 = x - 6$$

$$\Leftrightarrow x - 2y = 4$$

b) $A(1, -4) \xrightarrow{R((0, -2); 90^\circ)} A'(x', y')$

$$\Rightarrow A' = (1 \cdot \cos 90^\circ - (-2) \cdot \sin 90^\circ, \\ 1 \cdot \sin 90^\circ + (-2) \cdot \cos 90^\circ - 2) \\ = (1 \cdot 0 + 2 \cdot 1, 1 + (-2) \cdot 0 - 2)$$

$$\therefore A' = (2, -1)$$

$B(-3, 4) \xrightarrow{R((0, -2); 90^\circ)} B'(x', y')$

$$\Rightarrow B' = ((-3) \cdot \cos 90^\circ - 6 \cdot \sin 90^\circ, \\ (-3) \cdot \sin 90^\circ + 6 \cdot \cos 90^\circ - 2) \\ = ((-3) \cdot 0 - 6 \cdot 1, (-3) \cdot 1 + 6 \cdot 0 - 2)$$

$$\therefore B' = (-6, -5)$$

\therefore Persamaan garis $A'B'$:

$$= \frac{y - (-5)}{-1 - (-5)} = \frac{x - (-6)}{2 - (-6)}$$

$$\Leftrightarrow \frac{y + 5}{4} = \frac{x + 6}{8}$$

$$\Leftrightarrow 2(y + 5) = x + 6$$

$$\Leftrightarrow x - 2y = 4.$$

c) $A(1, -4) \xrightarrow{R((0, -2); 180^\circ)} A'(x', y')$

$$\Rightarrow A' = (1 \cdot \cos 180^\circ - (-2) \cdot \sin 180^\circ, \\ 1 \cdot \sin 180^\circ + (-2) \cdot \cos 180^\circ - 2) \\ = (1 \cdot (-1) - (-2) \cdot 0, 1 \cdot 0 + (-2) \cdot (-1) - 2)$$

$$\therefore A' = (-1, 0)$$

$B(-3, 4) \xrightarrow{R((0, -2); 180^\circ)} B'(x', y')$

$$\Rightarrow B' = ((-3) \cdot \cos 180^\circ - 6 \cdot \sin 180^\circ, \\ (-3) \cdot \sin 180^\circ + 6 \cdot \cos 180^\circ - 2) \\ = ((-3) \cdot (-1) - 6 \cdot 0, (-3) \cdot 0 + 6 \cdot (-1) - 2)$$

$$\therefore B' = (3, -8)$$

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∴ Persamaan garis A'B'

$$= \frac{y - (-8)}{0 - (-8)} = \frac{x - 3}{-1 - 3}$$

$$\Leftrightarrow \frac{y + 8}{8} = \frac{x - 3}{-4}$$

$$\Leftrightarrow y + 8 = -2(x - 3)$$

$$\Leftrightarrow 2x + y = -2.$$

13. $(x, y) \xrightarrow{R_{60^\circ}} (x', y')$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 60^\circ & -\sin 60^\circ \\ \sin 60^\circ & \cos 60^\circ \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\Rightarrow x' = \frac{1}{2}x - \frac{1}{2}\sqrt{3}y \dots \text{Pers(1)}$$

$$\Rightarrow y' = \frac{1}{2}\sqrt{3}x + \frac{1}{2}y \dots \text{Pers(2)}$$

• Pers(1) $\times 2\sqrt{3} \Rightarrow 2\sqrt{3}x' = \sqrt{3}x - 3y$

Pers(2) $\times 2 \Rightarrow 2y' = \sqrt{3}x + y$

$$\Rightarrow 2\sqrt{3}x' - 2y' = -4y$$

$$\Leftrightarrow y = \frac{1}{2}(y' - \sqrt{3}x')$$

• Pers(1) $\times 2 \Rightarrow 2x' = x - \sqrt{3}y$

Pers(2) $\times 2\sqrt{3} \Rightarrow 2\sqrt{3}y' = 3x + \sqrt{3}y$

$$\Leftrightarrow 2x' + 2\sqrt{3}y' = 4x$$

$$\Leftrightarrow x = \frac{1}{2}(x' + \sqrt{3}y')$$

∴ Bayangan lingkaran $y^2 + x^2 = 4$ oleh $R(0; 60^\circ)$

$$= \left(\frac{1}{2}(y - \sqrt{3}x) \right)^2 + \left(\frac{1}{2}(x + \sqrt{3}y) \right)^2 = 4$$

$$\Leftrightarrow \frac{1}{4}(y^2 - 2\sqrt{3}xy + 3x^2) + \frac{1}{4}(x^2 + 2\sqrt{3}xy + 3y^2) = 4$$

$$\Leftrightarrow \frac{1}{4}(4y^2 + 4x^2) = 4$$

$$\Leftrightarrow y^2 + x^2 = 4 //$$

14. $(x, y) \xrightarrow{R_{45^\circ}} (x', y')$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 45^\circ & -\sin 45^\circ \\ \sin 45^\circ & \cos 45^\circ \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\Rightarrow x' = \frac{1}{2}\sqrt{2} \cdot x - \frac{1}{2}\sqrt{2} \cdot y$$

$$y' = \frac{1}{2}\sqrt{2} \cdot x + \frac{1}{2}\sqrt{2} \cdot y$$

$$x' + y' = \sqrt{2} \cdot x$$

$$\Leftrightarrow x = \frac{1}{2}\sqrt{2}(x' + y')$$

$$\Rightarrow x' = \frac{1}{2}\sqrt{2} \cdot x - \frac{1}{2}\sqrt{2} \cdot y$$

$$y' = \frac{1}{2}\sqrt{2} \cdot x + \frac{1}{2}\sqrt{2} \cdot y$$

$$x' - y' = -\sqrt{2}y$$

$$\Leftrightarrow y = \frac{1}{2}\sqrt{2}(y' - x')$$

∴ Bayangan kurva $xy = 9$ oleh R_{45°

$$= \left(\frac{1}{2}\sqrt{2}(x' + y') \right) \left(\frac{1}{2}\sqrt{2}(y' - x') \right) = 9$$

$$\Leftrightarrow \frac{1}{2} \cdot \frac{1}{2} \cdot \sqrt{2} \cdot \sqrt{2} \cdot (x' + y')(y' - x') = 9$$

$$\Leftrightarrow \frac{1}{2}(y'^2 - x'^2) = 9$$

$$\Leftrightarrow y'^2 - x'^2 = 18$$

15. $(x, y) \xrightarrow{R((3, -1); -90^\circ)} (x', y')$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos(-90^\circ) & -\sin(-90^\circ) \\ \sin(-90^\circ) & \cos(-90^\circ) \end{pmatrix} \begin{pmatrix} x - 3 \\ y + 1 \end{pmatrix} + \begin{pmatrix} 3 \\ -1 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} x - 3 \\ y + 1 \end{pmatrix} + \begin{pmatrix} 3 \\ -1 \end{pmatrix}$$

$$\Rightarrow x' = (y + 1) + 3 = y + 4 \Leftrightarrow y = x' - 4$$

$$y' = -(x - 3) - 1 = -x + 2 \Leftrightarrow x = 2 - y'$$

∴ Bayangan garis $7x - 5y + 35 = 0$ oleh $R((3, -1); -90^\circ)$

$$= 7(2 - y') - 5(x' - 4) + 35 = 0$$

$$\Leftrightarrow -7y' - 5x' + 69 = 0$$

$$\Leftrightarrow 7y' + 5x' = 69 //$$

(20)

Uji Pemahaman Halaman 162

A. Pilihan Ganda

1. $A(-5, -2) \xrightarrow{D[(0,0); -2]} A' = (x', y')$

• $A' = (-5 \cdot (-2), -2 \cdot (-2)) = (10, 4)$

Jawaban: D

2. misalkan $P = (a, b)$

$F(5, -2) \xrightarrow{D[(a,b); -2]} F'(-22, 10)$

$\Rightarrow -22 = -2(5 - a) + a$

$\Rightarrow -22 = -10 + 3a$

$\Rightarrow 3a = -12$

$\Rightarrow a = -4$

• $10 = -2(-2 - b) + b$

$\Rightarrow 10 = 4 + 3b$

$\Rightarrow 3b = 6$

$\Rightarrow b = 2$

Jawaban: E

3. $A(p, q) \xrightarrow{D[(1,2); -5]} A'(66, -3)$

• $66 = -5(p - 1) + 1$

$\Rightarrow 66 = -5p + 5 + 1$

$\Rightarrow -5p = 60 \Rightarrow p = -12$

• $-3 = -5(q - 2) + 2$

$\Rightarrow -3 = -5q + 10 + 2$

$\Rightarrow 5q = 15 \Rightarrow q = 3$

$\therefore \left(\frac{p}{q}\right)^3 = \left(\frac{-12}{3}\right)^3 = (-4)^3 = -64$

Jawaban: A.

4. $(x, y) \xrightarrow{D[(s,s); k]} (x', y')$

$\Rightarrow x' = k(x - s) + s$

$\Rightarrow k(x - s) = x' - s$

$\Rightarrow x - s = \frac{1}{k}(x' - s)$

$\Rightarrow x = \frac{1}{k}(x' - s) + s$

• $y' = k(y - s) + s$

$\Rightarrow y = \frac{1}{k}(y' - s) + s$

• $x + 3y = 29 \xrightarrow{D[(s,s); k]} x + 3y = 38$

$\therefore \left(\frac{1}{k}(x - s) + s\right) + 3\left(\frac{1}{k}(y - s) + s\right) = 29$

$\equiv x + 3y = 38$

$\Rightarrow \left[\frac{1}{k}(x - s) + s + \frac{3}{k}(y - s) + 3s = 29\right] \times k$

$\Rightarrow x - s + sk + 3(y - s) + 3sk = 29k$

$\Rightarrow x + 3y - 20 + 20k = 29k$

$\Rightarrow x + 3y = 9k + 20 \equiv x + 3y = 38$

$\therefore 9k + 20 = 38 \Rightarrow 9k = 18 \Rightarrow k = 2$

Jawaban: E

5. $(x, y) \xrightarrow{D[(0,0); -\frac{1}{4}]} (x', y')$

$\Rightarrow x' = -\frac{1}{4}x \Rightarrow x = -4x'$

• $y' = -\frac{1}{4}y \Rightarrow y = -4y'$

\therefore Bayangan $y = x^2 - 10x$ oleh $D[(0,0); -\frac{1}{4}]$

$\equiv (-4y) = (-4x)^2 - 10(-4x)$

$\Rightarrow -4y = 16x^2 + 40x$

$\Rightarrow y = -4x^2 - 10x$

Jawaban: D

B. Uraian

1. a).

$$(3, 4) \xrightarrow{D[0; 2]} (2 \cdot 3, 2 \cdot 4) = (6, 8)$$

b).

$$(-2, 4) \xrightarrow{D[0; -4]} ((-4) \cdot (-2), (-4) \cdot 4) = (8, -16)$$

c).

$$(2, -1) \xrightarrow{D[0; 3]} (3 \cdot 2, 3 \cdot (-1)) = (6, -3)$$

d).

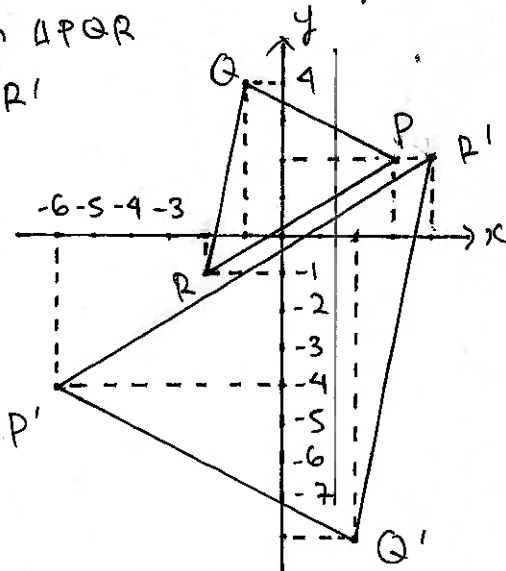
$$(-6, 2) \xrightarrow{D[0; \frac{1}{2}]} (\frac{1}{2} \cdot (-6), \frac{1}{2} \cdot 2) = (-3, 1)$$

e).

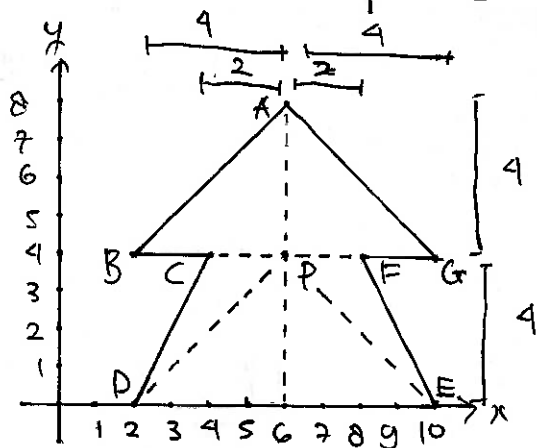
$$(12, 27) \xrightarrow{D[0; \frac{1}{3}]} (\frac{1}{3} \cdot 12, \frac{1}{3} \cdot 27) = (4, 9)$$

2. Bangunan $\triangle PQR$

$$\equiv \triangle P'Q'R'$$

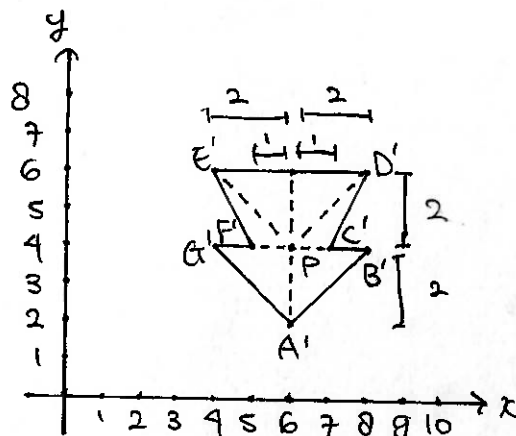


3. a).



Bentuk bangun di atas merupakan bangun datar yang digabungkan antara bangun datar segitiga dan bangun datar trapesium dimana segitiga yang berada di atas trapesium

b).



4. Karena $\triangle BPQ$ adalah hasil dilatasi dari $\triangle ABC$

a). Faktor skalar = $\frac{PQ}{BC} = \frac{5,5}{3,3} = \frac{5}{3}$

b). $\circ DB = x AB$

\circ Karena faktor skalar = $\frac{5}{3}$

$$\Rightarrow DP = \frac{5}{3} DB$$

$$\Leftrightarrow 3 DP = 5 DB$$

$$\Leftrightarrow 3 (DB + BP) = 5 DB$$

$$\Leftrightarrow 3 DB + 3 \cdot BP = 5 DB$$

$$\Leftrightarrow 2 DB = 3 \cdot BP = 3 \cdot 2,5 = 7,5$$

$$\Leftrightarrow DB = \frac{7,5}{2} = 3,75$$

$\circ DB = x AB$

$$\Leftrightarrow 3,75 = x \cdot 1,5$$

$$\Leftrightarrow x = \frac{3,75}{1,5} = \frac{7,5}{3} = 2,5$$

c). $DA = DB - AB = 3,75 - 1,5 = 2,25 \text{ cm}$

5. a). $\triangle OAB \longrightarrow \triangle O_1 A_1 B_1$

karena A tidak berubah setelah didilatasi

\therefore A adalah pusat dilatasi =

\circ Faktor dilatasi = $\frac{AO_1}{AO} = \frac{-(3 + 1\frac{1}{2})}{-(1\frac{1}{2})} = \frac{\frac{9}{2}}{\frac{3}{2}} = 3$

b). $\triangle OAB \longrightarrow \triangle O_2 A_2 B$

\Rightarrow Pusat dilatasi = B(0, 3)

\circ Faktor dilatasi = $\frac{BO_2}{BO} = \frac{5}{-3} = -\frac{5}{3}$

Uji Pemahaman Halaman 162

c). $\triangle OAB \longrightarrow \triangle OA_3B_3$

\therefore Pusat dilatasi = $O(0,0)$

Faktor dilatasi = $\frac{OB_3}{OB} = \frac{-2}{3} = -\frac{2}{3}$

6.

$ABCDE \xrightarrow{D[C; -2]} A'B'C'D'E'$

dimana $A(0,3); B(4,-2); C(0,-1);$

$D(-2,0);$ dan $E(-4,2)$

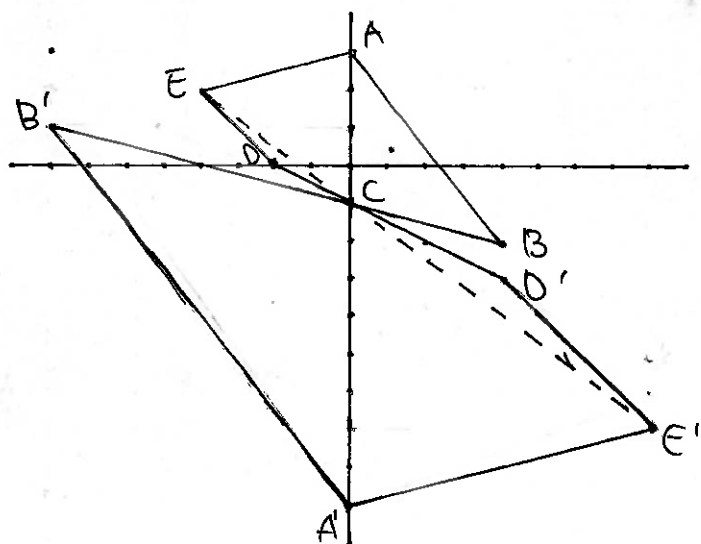
$\Rightarrow A' = ((-2) \cdot (0-0) + 0, (-2) \cdot (3-(-1)) + (-1))$
 $= (0, -9)$

$\Rightarrow B' = ((-2) \cdot (4-0) + 0, (-2) \cdot (-2-(-1)) + (-1))$
 $= (-8, 1)$

$\Rightarrow C' = C = (0, -1)$

$\Rightarrow D' = ((-2) \cdot (-2-0) + 0, (-2) \cdot (0-(-1)) + (-1))$
 $= (4, -3)$

$\Rightarrow E' = ((-2) \cdot (-4-0) + 0, (-2) \cdot (2-(-1)) + (-1))$
 $= (8, -7)$



7.a).

$A(2,1) \xrightarrow{D[(4,3); 2]} A'$, dimana
 $A' = (2 \cdot (2-4) + 4, 2 \cdot (1-3) + 3)$
 $= (0, -1)$

b).

$B(-3,2) \xrightarrow{D[(3,-1); \frac{1}{2}]} B'$, dimana
 $B' = (\frac{1}{2} \cdot (-3-3) + 3, \frac{1}{2} \cdot (2-(-1)) + (-1))$
 $= (0, \frac{1}{2})$

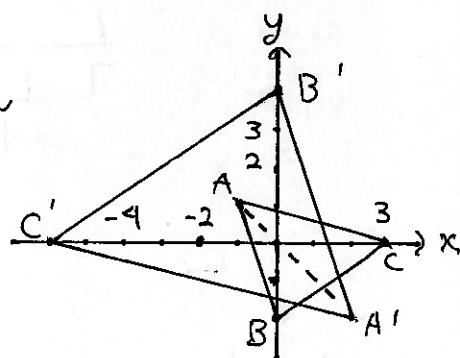
c).

$C(4,-1) \xrightarrow{D[(0,5); -\frac{1}{2}]} C'$, dimana
 $C' = (-\frac{1}{2} \cdot (4-0) + 0, -\frac{1}{2} \cdot (-1-5) + 5)$
 $= (-2, 8)$

d).

$D(0,-6) \xrightarrow{D[(-3,2); -3]} D'$, dimana
 $D' = (-3 \cdot (-6-(-3)) + (-3), -3 \cdot (-6-2) + 2)$
 $= (6, 26)$

8a).



b). Perhatikan perpotongan AA' , BB' , dan CC' yang terjadi di titik $(0,0)$

\therefore Pusat dilatasi = titik $(0,0)$

Misalkan titik $O = (0,0)$

\therefore Faktor skalar = $\frac{OB'}{OB} = \frac{4}{-2} = -2 //$

Uj: Pemahaman Halaman 162

9a) $EFGH \xrightarrow{D[0;2]} E'F'G'H'$

$\Rightarrow OF' = 2 \times OF = 2 \times 2$ satuan miring
berdasarkan gambar $F' = Q$, dan

berarti $E'F'G'H' = PQRS$

b) $ABCD \xrightarrow{D[0;\frac{1}{3}]} A'B'C'D'$

$\Rightarrow OB' = \frac{1}{3} \times 6$ satuan miring
 $= 2$ satuan miring.

$\therefore B' = F$

$\therefore A'B'C'D' = EFGH$

10. Untuk menjawab soal ini fokus ke
perpindahan titik pada garis EQ .

a) $\left. \begin{array}{l} \overrightarrow{HB} = \begin{pmatrix} -1 \\ 4 \end{pmatrix} \\ \overrightarrow{HQ} = \begin{pmatrix} -2 \\ 8 \end{pmatrix} \end{array} \right\} \therefore \text{nilai } k = \frac{8}{4} = 2$

$\Rightarrow \triangle ABC \xrightarrow{D[H;2]} \triangle PQR$

b) $\left. \begin{array}{l} \overrightarrow{HB} = \begin{pmatrix} -1 \\ 4 \end{pmatrix} \\ \overrightarrow{HE} = \begin{pmatrix} 1 \\ -4 \end{pmatrix} \end{array} \right\} \therefore \text{nilai } k = \frac{-4}{4} = -1$

$\Rightarrow \triangle ABC \xrightarrow{D[H;-1]} \triangle DEF$

Uji Pemahaman Halaman 165

A. Pilihan Ganda

$$1. T_2 \circ T_1 = \begin{pmatrix} -2 & 7 \\ -1 & 4 \end{pmatrix} = \begin{pmatrix} 5 \\ 3 \end{pmatrix}$$

$$\therefore A(-9, 5) \xrightarrow{T_2 \circ T_1 = \begin{pmatrix} 5 \\ 3 \end{pmatrix}} A'(-9+5, 5+3) = A'(-4, 8).$$

Jawabani D

$$2. T_2 \circ T_1 = \begin{pmatrix} -9 & (-6) \\ 3 & 2 \end{pmatrix} = \begin{pmatrix} -15 \\ 5 \end{pmatrix}$$

$$\therefore B(m, n) \xrightarrow{T_2 \circ T_1} B''(-2, 3)$$

$$\Rightarrow -2 = m + (-15) \Leftrightarrow m = 13$$

$$\bullet 3 = n + 5 \Leftrightarrow n = -2.$$

$$\therefore m + 7n = 13 + 7(-2) = -1$$

Jawaban: A

$$3. T_2 \circ T_1 = \begin{pmatrix} 1 & 7 \\ 7 & 1 \end{pmatrix} = \begin{pmatrix} 8 \\ 8 \end{pmatrix}$$

$$(x, y) \xrightarrow{T_2 \circ T_1} (x'', y'')$$

$$\Rightarrow x'' = x + 8 \Leftrightarrow x = x'' - 8$$

$$\bullet y'' = y + 8 \Leftrightarrow y = y'' - 8$$

\therefore Bayangan garis $3x - 2y + 12 = 0$ oleh translasi $T_2 \circ T_1$

$$\equiv 3(x-8) - 2(y-8) + 12 = 0$$

$$\Leftrightarrow 3x - 24 - 2y + 16 + 12 = 0$$

$$\Leftrightarrow 3x - 2y + 4 = 0$$

$$\Leftrightarrow -3x + 2y - 4 = 0$$

Jawaban: B.

$$4. T_2 \circ T_1 = \begin{pmatrix} -4 & 12 \\ 1 & (-7) \end{pmatrix} = \begin{pmatrix} 8 \\ -6 \end{pmatrix}$$

$$(x, y) \xrightarrow{T_2 \circ T_1} (x', y')$$

$$\Rightarrow x' = x + 8 \Leftrightarrow x = x' - 8$$

$$\bullet y' = y - 6 \Leftrightarrow y = y' + 6$$

\therefore Bayangan parabola $y = x^2$ oleh $T_2 \circ T_1$

$$\equiv (y+6) = (x-8)^2$$

$$\Leftrightarrow y = (x-8)^2 - 6$$

$$5. T_2 \circ T_1 = \begin{pmatrix} a & (-2) \\ 2 & b \end{pmatrix} = \begin{pmatrix} a-2 \\ b+2 \end{pmatrix}$$

$$(x, y) \xrightarrow{T_2 \circ T_1} (x', y')$$

$$\Rightarrow x' = x + a - 2 \Leftrightarrow x = x' - a + 2$$

$$\bullet y' = y + b + 2 \Leftrightarrow y = y' - b - 2$$

karena

$$y = 3x^2 + 5x + 6 \xrightarrow{T_2 \circ T_1} y = 3x^2 - 25x + 60$$

$$\therefore (y - b - 2) = 3(x + a - 2)^2 + 5(x + a - 2) + 6$$

$$\equiv y = 3x^2 - 25x + 60 \dots \text{Pernyataan (1)}$$

$$\bullet (y - b - 2) = 3(x + a - 2)^2 + 5(x + a - 2) + 6$$

$$\Leftrightarrow y - b - 2 = 3(x^2 + 2(a-2)x + (a-2)^2) + 5x + 5a - 10 + 6$$

$$\Leftrightarrow y = 3x^2 + (6(a-2) + 5)x + (3(a-2)^2 + 5a - 10 + 6 + b + 2)$$

\bullet Pernyataan 1

Pernyataan (2),

$$\Rightarrow -25 = 6(a-2) + 5$$

$$\Leftrightarrow -30 = 6(a-2)$$

$$\Leftrightarrow a - 2 = -5 \Leftrightarrow a = -3.$$

\bullet Pernyataan 2 dan $a = -3$

$$\Rightarrow 60 = 3(-3-2)^2 + 5(-3) - 10 + 6 + b + 2$$

$$\Leftrightarrow 60 = 3 \cdot 25 - 17 + b.$$

$$\Leftrightarrow b = 60 + 17 - 75 = 2$$

$$\therefore a - b = -3 - 2 = -5$$

Jawaban: C

Uji Pemahaman Halaman 165

B. Uraian

1. a). $T_2 \circ T_1 = \begin{pmatrix} 2+5 \\ 3+4 \end{pmatrix} = \begin{pmatrix} 7 \\ 7 \end{pmatrix}$

$\Rightarrow (5, 7) \xrightarrow{T_2 \circ T_1} (5+7, 7+7) = (12, 14)$

b). $T_2 \circ T_1 = \begin{pmatrix} 4+(-5) \\ -7+11 \end{pmatrix} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$

$\Rightarrow (-4, 8) \xrightarrow{T_2 \circ T_1} (-4+(-1), 8+4) = (-5, 12)$

c). $T_2 \circ T_1 = \begin{pmatrix} 7+(-7) \\ -5+5 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$

$\Rightarrow (-27, 42) \xrightarrow{T_2 \circ T_1} (-27, 42)$

2. $T_2 \circ T_1 = \begin{pmatrix} 5+(-3) \\ 1+(-4) \end{pmatrix} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$

$\Delta PQR \xrightarrow{T_2 \circ T_1} \Delta P'Q'R'$, dimana

$\circ P(5, 2) \xrightarrow{T_2 \circ T_1} P' = (5+2, 2+(-3)) = (7, -1)$

$\circ Q(-1, 4) \xrightarrow{T_2 \circ T_1} Q' = (-1+2, 4+(-3)) = (1, 1)$

$\circ R(-4, -2) \xrightarrow{T_2 \circ T_1} R' = (-4+2, -2+(-3)) = (-2, -5)$

3. a). $T_1 \circ T_2 = \begin{pmatrix} x_2+x_1 \\ y_2+y_1 \end{pmatrix} = \begin{pmatrix} x_1+x_2 \\ y_1+y_2 \end{pmatrix} = T_2 \circ T_1$

karena berlaku sifat komutatif penjumlahan untuk x_1, x_2, y_1 , dan y_2

$\therefore T_1 \circ T_2 = T_2 \circ T_1$

b). $\Delta T_2 \circ T_3 = \begin{pmatrix} x_3+x_2 \\ y_3+y_2 \end{pmatrix}$

$\circ T_1 \circ (T_2 \circ T_3) = \begin{pmatrix} (x_3+x_2)+x_1 \\ (y_3+y_2)+y_1 \end{pmatrix} = \begin{pmatrix} x_1+(x_3+x_2) \\ y_1+(y_3+y_2) \end{pmatrix} = \begin{pmatrix} x_1+x_2+x_3 \\ y_1+y_2+y_3 \end{pmatrix}$

$T_1 \circ (T_2 \circ T_3) = \begin{pmatrix} x_1+x_2+x_3 \\ y_1+y_2+y_3 \end{pmatrix}$

karena " x_1, x_2, x_3, y_1, y_2 , dan y_3 berlaku sifat komutatif dan asosiatif terhadap penjumlahan" ... Pernyataan (1)

$\Delta T_1 \circ T_2 = \begin{pmatrix} x_1+x_2 \\ y_1+y_2 \end{pmatrix}$... bagian a).

$\circ (T_1 \circ T_2) \circ T_3 = \begin{pmatrix} x_3+(x_1+x_2) \\ y_3+(y_1+y_2) \end{pmatrix} = \begin{pmatrix} x_1+x_2+x_3 \\ y_1+y_2+y_3 \end{pmatrix}$

karena Pernyataan (1)

$\therefore T_1 \circ (T_2 \circ T_3) = (T_1 \circ T_2) \circ T_3$

4. $T_2 \circ T_1 = \begin{pmatrix} -5+1 \\ -2+5 \end{pmatrix} = \begin{pmatrix} -4 \\ 3 \end{pmatrix}$

$\Rightarrow x' = x + (-4) \Leftrightarrow x = x' + 4$

$\circ y' = y + 3 \Leftrightarrow y = y' - 3$

\therefore Bayangan parabola $y = x^2 + 9$ oleh $T_2 \circ T_1$

$\equiv y - 3 = (x+4)^2 + 9 \Leftrightarrow y = (x+4)^2 + 12$

5. $l \equiv y = x^2 - 4x + 3 \equiv y + 1 = x^2 - 4x + 4 \equiv y + 1 = (x-2)^2$

karena $l_1 \equiv y = x^2 - 4x \equiv y + 4 = x^2 - 4x + 4 \equiv (y+3)+1 = (x-2)^2$

dan $l \xrightarrow{T_1} l_1$...

$\therefore x = x' \Leftrightarrow x' = x + 0$, dan

$y = y' + 3 \Leftrightarrow y' = y + (-3)$

$\Rightarrow T_1 = \begin{pmatrix} 0 \\ -3 \end{pmatrix}$

karena $l_2 \equiv y = x^2 + 3$

$\equiv y - 3 = x^2$

$\equiv (y-4)+1 = ((x+2)-2)^2$

dan $l \xrightarrow{T_2} l_1 \Rightarrow x = x' + 2 \Leftrightarrow x' = x - 2$

$y = y' - 4 \Leftrightarrow y' = y + 4$

$\Rightarrow T_2 = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$

Uji Pemahaman Halaman 165

$$T_2 \circ T_1 = \begin{pmatrix} -2+0 \\ 1+(-3) \end{pmatrix} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$$

$$(x, y) \xrightarrow{T_1 \circ T_2} (x', y'), \text{ dimana}$$

$$\circ x' = x + (-2) (\Leftrightarrow) x = x' + 2$$

$$\circ y' = y + 1 (\Leftrightarrow) y = y' - 1$$

\Rightarrow Bayangan parabola $l: y+1 = (x-2)^2$
oleh $T_1 \circ T_2$

$$\equiv (y-1)+1 = ((x+2)-2)^2$$

$$\Leftrightarrow y = x^2$$

Uji Pemahaman Halaman 170

A. Pilihan ganda

$$1. y+3=0 \Leftrightarrow y=-3 \Rightarrow M_{y+3=0} = M_{y=-3}$$

Misalkan $M_1 = M_{y=-3}$, dan

$$M_2 = M_{y=4}$$

$$A(7, -3) \xrightarrow{M_1} A'(x', y') \xrightarrow{M_2} A''(x'', y'')$$

$$\bullet x'' = x' = x = 7$$

$$\bullet y' = 2 \cdot (-3) - (-3) = -3$$

$$\Rightarrow y'' = 2 \cdot (4) - (-3) = 11$$

\therefore Bayangan titik A adalah $(7, 11)$

Jawaban: A.

2. Karena berotasi di pusat yang sama yaitu $(0, 0)$

$$\Rightarrow R_{75^\circ} \circ R_{15^\circ} = R_{(75+15)^\circ} = R_{90^\circ}$$

$$\therefore B(u, v) \xrightarrow{R_{90^\circ}} B''(7, -5)$$

$$\Rightarrow \begin{pmatrix} 7 \\ -5 \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} u \\ v \end{pmatrix}$$

$$\begin{pmatrix} 7 \\ -5 \end{pmatrix} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} u \\ v \end{pmatrix}$$

$$\Rightarrow \begin{cases} 7 = -v \Leftrightarrow v = -7 \\ -5 = u \Leftrightarrow u = -5 \end{cases} \Rightarrow u + v = -12$$

Jawaban: A.

$$3. M_1 = M_{y=3} \text{ dan } M_2 = M_{x=2}$$

$$(x, y) \xrightarrow{M_2 \circ M_1} (x', y'), \text{ dimana}$$

$$\Rightarrow x' = 2 \cdot 2 - x \Leftrightarrow x = 4 - x'$$

$$y' = 2 \cdot 3 - y \Leftrightarrow y = 6 - y'$$

$$\bullet y = x^2 - 2x - 15 \Leftrightarrow y + 16 = x^2 - 2x + 1$$

$$\Leftrightarrow y + 16 = (x - 1)^2$$

$$\therefore \text{ Bayangan } y = x^2 - 2x - 15$$

$$\equiv \text{ Bayangan } y + 16 = (x - 1)^2$$

$$\equiv (6 - y) + 16 = ((4 - x) - 1)^2$$

$$\equiv -y + 22 = (3 - x)^2$$

$$\equiv y = -(x - 3)^2 + 22$$

$$\equiv y = -x^2 + 6x + 13$$

Jawaban: A.

$$4. \text{ Sumbu } x \equiv \text{ garis } y = 0$$

$$M_1 = M_{y=0}$$

$$(x, y) \xrightarrow{M_1} (x', y') = (x, -y)$$

$$M_2 = M_{y=x}$$

$$(x', y') \xrightarrow{M_2} (x'', y'') = (y', x')$$

$$\Rightarrow \bullet x'' = y' = -y \Leftrightarrow y = -x''$$

$$\bullet y'' = x' = x \Leftrightarrow x = y''$$

$$\therefore \text{ Bayangan } y = -5x + 5 \text{ oleh } M_2 \circ M_1$$

$$\equiv (-x) = -5(y) + 5$$

$$\equiv \frac{1}{5}x = y - 1 \equiv y = \frac{1}{5}x + 1$$

Jawaban: C.

$$5. R[(1, -4); 195^\circ] \circ R[(1, -4); 255^\circ]$$

$$= R[(1, -4); 255^\circ + 195^\circ]$$

$$= R[(1, -4); 450^\circ]$$

$$= R[(1, -4); 360^\circ + 90^\circ]$$

$$= R[(1, -4); 90^\circ]$$

\therefore

$$(x, y) \xrightarrow{R[(1, -4); 195^\circ] \circ R[(1, -4); 255^\circ]} (x', y')$$

$$\equiv (x, y) \xrightarrow{R[(1, -4); 90^\circ]} (x', y')$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} x-1 \\ y+4 \end{pmatrix} + \begin{pmatrix} 1 \\ -4 \end{pmatrix}$$

(28)

$$\Leftrightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x-1 \\ y+4 \end{pmatrix} + \begin{pmatrix} 1 \\ -4 \end{pmatrix}$$

Uji Pemahaman Halaman 170

$$\Rightarrow x' = -(y+4) + 1 = -y - 3 \Leftrightarrow y = -x' - 3$$

$$y' = (x-1) + (-4) = x - 5 \Leftrightarrow x = y' + 5$$

\therefore Bayangan garis $5x - 6y - 15 = 0$

$$\text{oleh } R[(1, -4); 195^\circ] \circ R[(1, -4); 255^\circ]$$

$$\equiv 5(y+5) - 6(-x-3) - 15 = 0$$

$$\equiv 5y + 25 + 6x + 18 - 15 = 0$$

$$\equiv 6x + 5y + 28 = 0$$

Jawaban: E

B. Uraian

1.a). $(5, 3) \xrightarrow{M_{x=2}} (2 \cdot 2 - 5, 3)$

$$\equiv (5, 3) \xrightarrow{M_{x=2}} (-1, 3)$$

$$\circ (-1, 3) \xrightarrow{M_{x=6}} (2 \cdot 6 - (-1), 3)$$

$$\equiv (-1, 3) \xrightarrow{M_{x=6}} (13, 3)$$

$$\therefore (5, 3) \xrightarrow{M_{x=6} \circ M_{x=2}} (13, 3)$$

b). $(-4, -3) \xrightarrow{M_{x=3}} (2 \cdot 3 - (-4), -3)$

$$\equiv (-4, -3) \xrightarrow{M_{x=3}} (10, -3)$$

$$\circ (10, -3) \xrightarrow{M_{x=-2}} (2 \cdot (-2) - 10, -3)$$

$$(10, -3) \xrightarrow{M_{x=-2}} (-14, -3)$$

$$\therefore (-4, -3) \xrightarrow{M_{x=-2} \circ M_{x=3}} (-14, -3)$$

atau

$$(-4, -3) \xrightarrow{M_{x=2} \circ M_{x=3}} (x', y')$$

dimana

$$x' = (2 \cdot (-2) - (2 \cdot 3 - (-4)))$$

$$= -4 - 10 = -14, \text{ dan}$$

$$y' = -3$$

c). $(-4, 3) \xrightarrow{M_{x=3} \circ M_{x=-2}} (x', y')$, dimana
 $x' = 2 \cdot 3 - (2 \cdot (-2) - (-4)) = 6$, dan $y' = 3$

d). $(-2, -4) \xrightarrow{M_{x=-2} \circ M_{x=-5}} (x', y')$, dimana
 $\circ x' = 2 \cdot (-2) - (2 \cdot (-5) - (-2)) = 4$, dan
 $\circ y' = -4$

e). $(5, 2) \xrightarrow{M_{y=7} \circ M_{y=2}} (x', y')$ dimana
 $\circ x' = 5$, dan
 $\circ y' = 2 \cdot 7 - (2 \cdot 2 - 2) = 12$

f). $(5, 2) \xrightarrow{M_{y=2} \circ M_{y=7}} (x', y')$ dimana
 $\circ x' = 5$, dan
 $\circ y' = 2 \cdot 2 - (2 \cdot 7 - 2) = -8$

g). $(-2, 7) \xrightarrow{M_{y=7} \circ M_{y=4}} (x', y')$ dimana
 $\circ x' = -2$, dan
 $\circ y' = 2 \cdot 7 - (2 \cdot 4 - 7) = 13$

h). $(4, 1) \xrightarrow{M_{y=3} \circ M_{x=-5}} (x', y')$ dimana
 $\circ x' = 2 \cdot (-5) - 4 = -14$, dan
 $\circ y' = 2 \cdot 3 - 1 = 5$.

2. Bayangan titik $(5, 7)$ oleh transformasi

a). $M_1 \circ M_2 = M_{x=4} \circ M_{y=3}$
 $\equiv (2 \cdot 4 - 5, 2 \cdot 3 - 7) = (3, -1)$

b). $M_2 \circ M_3 = M_{y=3} \circ M_{x=-1}$
 $\equiv (2 \cdot (-1) - 5, 2 \cdot 3 - 7) = (-7, -1)$

c). $M_1 \circ M_2 \circ M_3 = M_1 \circ (M_2 \circ M_3)$
 $= M_{x=4} \circ (M_2 \circ M_3)$

$$\equiv (x', y'), \text{ dimana}$$

$$(5, 7) \xrightarrow{M_2 \circ M_3} (-7, -1) \xrightarrow{M_{x=4}} (x', y')$$

$$\circ x' = 2 \cdot 4 - (-7) = 15, \text{ dan}$$

$$y' = -1$$

$$3. (2, 3) \xrightarrow{M_{y=-x}} (x', y') \xrightarrow{M_y} (x'', y'')$$

$$\Rightarrow x'' = -x' = -(-3) = 3$$

$$\Rightarrow y'' = y' = -2$$

4. Bayangan pada soal ini: (x', y')

$$a). (3, 5) \xrightarrow{R_{270^\circ} \circ R_{90^\circ}} (x', y')$$

$$\Leftrightarrow (3, 5) \xrightarrow{R_{(90+270)^\circ}} (x', y')$$

$$\Leftrightarrow (3, 5) \xrightarrow{R_{360^\circ}} (x', y')$$

$$\therefore (x', y') = (3, 5)$$

$$b). (-4, 3) \xrightarrow{R_{60^\circ} \circ R_{30^\circ}} (x', y')$$

$$\Leftrightarrow (-4, 3) \xrightarrow{R_{(30+60)^\circ}} (x', y')$$

$$\Leftrightarrow (-4, 3) \xrightarrow{R_{90^\circ}} (x', y')$$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} -4 \\ 3 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} -4 \\ 3 \end{pmatrix} = \begin{pmatrix} -3 \\ -4 \end{pmatrix}$$

$$\therefore (x', y') = (-3, -4)$$

$$c). (-2, 4) \xrightarrow{R_{120^\circ} \circ R_{150^\circ}} (x', y')$$

$$\Leftrightarrow (-2, 4) \xrightarrow{R_{(150+120)^\circ}} (x', y')$$

$$\Leftrightarrow (-2, 4) \xrightarrow{R_{270^\circ}} (x', y')$$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 270^\circ & -\sin 270^\circ \\ \sin 270^\circ & \cos 270^\circ \end{pmatrix} \begin{pmatrix} -2 \\ 4 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} -2 \\ 4 \end{pmatrix} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$$

$$\therefore (x', y') = (4, 2)$$

$$d). (3, 5) \xrightarrow{R_{150^\circ} \circ R_{30^\circ}} (x', y')$$

$$\Leftrightarrow (3, 5) \xrightarrow{R_{(30+150)^\circ}} (x', y')$$

$$\Leftrightarrow (3, 5) \xrightarrow{R_{180^\circ}} (x', y')$$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 180^\circ & -\sin 180^\circ \\ \sin 180^\circ & \cos 180^\circ \end{pmatrix} \begin{pmatrix} 3 \\ 5 \end{pmatrix}$$

$$= \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} 3 \\ 5 \end{pmatrix} = \begin{pmatrix} -3 \\ -5 \end{pmatrix}$$

$$\therefore (x', y') = (-3, -5)$$

5. a).

$$\circ P(1, 1) \xrightarrow{M_{x=-1} \circ M_{x=2}} P_a, \text{ dimana}$$

$$P_a = (2(-1) - 2(2) + 1, 1) = (-5, 1)$$

$$\circ Q(-3, 4) \xrightarrow{M_{x=-1} \circ M_{x=2}} Q_a, \text{ dimana}$$

$$Q_a = (2(-1) - 2(2) + (-3), 4) = (-9, 4)$$

$$\circ R(-2, -1) \xrightarrow{M_{x=-1} \circ M_{x=2}} R_a, \text{ dimana}$$

$$R_a = (2(-1) - 2(2) + (-2), -1) = (-8, -1)$$

$$\therefore \Delta PQR \xrightarrow{M_{x=-1} \circ M_{x=2}} \Delta P_a Q_a R_a$$

dimana $P_a(-5, 1); Q_a(-9, 4); R_a(-8, -1)$.

b).

$$\circ P(1, 1) \xrightarrow{M_{y=3} \circ M_{y=-1}} P_b, \text{ dimana}$$

$$P_b = (1, 2(3) - 2(-1) + 1) = (1, 9)$$

$$\circ Q(-3, 4) \xrightarrow{M_{y=3} \circ M_{y=-1}} Q_b, \text{ dimana}$$

$$Q_b = (-3, 2(3) - 2(-1) + 4) = (-3, 12)$$

$$\circ R(-2, -1) \xrightarrow{M_{y=3} \circ M_{y=-1}} R_b, \text{ dimana}$$

$$R_b = (-2, 2(3) - 2(-1) + (-1)) = (-2, 7)$$

$$\therefore \Delta PQR \xrightarrow{M_{y=3} \circ M_{y=-1}} \Delta P_b Q_b R_b$$

dimana $P_b(1, 9); Q_b(-3, 12);$

$$R_b(-2, 7).$$

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c). $P(1,1) \xrightarrow{M_x=5 \circ M_y=4} P_c$, dimana

$$P_c = (2(5)-1, 2(4)-1) = (9, 7)$$

$Q(-3,4) \xrightarrow{M_x=5 \circ M_y=4} Q_c$, dimana

$$Q_c = (2(5)-(-3), 2(4)-4) = (13, 4)$$

$R(-2,-1) \xrightarrow{M_x=5 \circ M_y=4} R_c$, dimana

$$R_c = (2(5)-(-2), 2(4)-(-1)) = (12, 9)$$

$\therefore \Delta PQR \xrightarrow{M_x=5 \circ M_y=4} \Delta P_c Q_c R_c$
dimana $P_c(9,7); Q_c(13,4); R_c(12,9)$.

6. Sumbu Y \equiv garis $x=0$

$\therefore M_y = M_{x=0}$

$M_1 = M_{x=6}$

$M_2 = M_{x=11}$

a). $A(-1,1) \xrightarrow{M_y \circ M_1} A_a$, dimana
 $A_a = (2(0)-2(6)+(-1), 1) = (-13, 1)$

$B(-2,6) \xrightarrow{M_y \circ M_1} B_a$, dimana
 $B_a = (2(0)-2(6)+(-2), 6) = (-14, 6)$

$C(-4,4) \xrightarrow{M_y \circ M_1} C_a$, dimana
 $C_a = (2(0)-2(6)+(-4), 4) = (-16, 4)$

$\therefore \Delta ABC \xrightarrow{M_y \circ M_1} \Delta A_a B_a C_a$
dimana $A_a(-13,1); B_a(-14,6); C_a(-16,4)$

b). $\Delta ABC \xrightarrow{M_1 \circ M_y} \Delta A_b B_b C_b$, dimana
 $A_b = (2(6)-2(0)+(-1), 1) = (11, 1)$
 $B_b = (2(6)-2(0)+(-2), 6) = (10, 6)$
 $C_b = (2(6)-2(0)+(-4), 4) = (8, 4)$

c). $A(-1,1) \xrightarrow{M_2 \circ M_1 \circ M_y} A_c$ dimana
 $A_c = (2(11)-2(6)+2(0)-(-1), 1)$
 $= (11, 1)$

$B(-2,6) \xrightarrow{M_2 \circ M_1 \circ M_y} B_c$ dimana
 $B_c = (2(11)-2(6)+2(0)-(-2), 6)$
 $= (12, 6)$

$C(-4,4) \xrightarrow{M_2 \circ M_1 \circ M_y} C_c$ dimana
 $C_c = (2(11)-2(6)+2(0)-(-4), 4)$
 $= (19, 4)$

$\therefore \Delta ABC \xrightarrow{M_2 \circ M_1 \circ M_y} \Delta A_c B_c C_c$
dimana $A_c(11,1); B_c(12,6); C_c(19,4)$

d). $A(-1,1) \xrightarrow{M_1 \circ M_2 \circ M_y} A_d$ dimana
 $A_d = (2(6)-2(11)+2(0)-(-1), 1) = (-9, 1)$

$B(-2,6) \xrightarrow{M_1 \circ M_2 \circ M_y} B_d$ dimana
 $B_d = (2(6)-2(11)+2(0)-(-2), 6) = (-8, 6)$

$C(-4,4) \xrightarrow{M_1 \circ M_2 \circ M_y} C_d$ dimana
 $C_d = (2(6)-2(11)+2(0)-(-4), 4) = (-6, 4)$

$\therefore \Delta ABC \xrightarrow{M_1 \circ M_2 \circ M_y} \Delta A_d B_d C_d$
dimana $A_d(-9,1); B_d(-8,6); C_d(-6,4)$

e). $\Delta ABC \xrightarrow{M_1 \circ M_y \circ M_2} \Delta A_e B_e C_e$, dimana
 $A_e = (2(6)-2(0)+2(11)-(-1), 1)$
 $= (35, 1)$
 $B_e = (2(6)-2(0)+2(11)-(-2), 6)$
 $= (38, 6)$
 $C_e = (2(6)-2(0)+2(11)-(-4), 4)$
 $= (38, 4)$

7. $M_1 = M_{x=1}$

$M_2 = M_{x=2}$

$M_3 = M_{x=4}$

a). Bayangan titik P (3,5) oleh transformasi

(i). $M_1 \equiv P_1 = (2(1)-3, 5) = (-1, 5)$

(ii) $M_2 \equiv P_2 = (2(2)-3, 5) = (1, 5)$

(iii) $M_1 \circ M_2 \circ M_3$

$\equiv P_3 = (2(1)-2(2)+2(4)-3, 5)$
 $= (3, 5)$

b). Misalkan garis $l \equiv y+x=7$, dan bayangan (x, y) oleh transformasi

(i) $M_1 \equiv (x_1, y_1)$, dimana

$\bullet x_1 = 2(1)-x \Rightarrow x = 2-x_1$

$\bullet y_1 = y \Rightarrow y = y_1$

\therefore garis $l \xrightarrow{M_1}$ garis l_1 , dimana

$l_1 \equiv (y) + (2-x) = 7 \equiv y-x=5$

(ii) $M_2 \equiv (x_2, y_2)$, dimana

$\bullet x_2 = 2(2)-x \Rightarrow x = 4-x_2$

$\bullet y_2 = y \Rightarrow y = y_2$

\therefore garis $l \xrightarrow{M_2}$ garis l_2 dimana

$l_2 \equiv (y) + (4-x) = 7 \equiv y-x=3$

(iii) $M_3 \circ M_2 \circ M_1 \equiv (x_3, y_3)$, dimana

$\bullet x_3 = 2(4)-2(2)+2(1)-x$

$\Rightarrow x = 6-x_3$

$\bullet y_3 = y \Rightarrow y = y_3$

\therefore garis $l \xrightarrow{M_3 \circ M_2 \circ M_1}$ garis l_3 , 32

$\bullet l_3 \equiv (y) + (6-x) = 7 \Rightarrow y-x=1$

8. $(x, y) \xrightarrow{M_x} (x', y') \xrightarrow{M_{y=x}} (x'', y'')$
 $\Rightarrow x'' = y' = -y \Rightarrow y = -x''$

$\bullet y'' = x' = x \Rightarrow x = y''$

\therefore Bayangan lingkaran $(x-2)^2 + (y-4)^2 = 36$ oleh transformasi $M_{y=x} \circ M_x$

$\equiv (y-2)^2 + ((-x)-4)^2 = 36$

$\equiv (y-2)^2 + (x+4)^2 = 36$

9. $(6, 0) \xrightarrow{M_{y=\sqrt{3}x}} (x', y') \xrightarrow{M_{y=-x}} (x'', y'')$

\Rightarrow garis yang melalui $(6, 0)$ dan (x', y') akan tegak lurus garis $y = \sqrt{3}x$.

$\therefore y-0 = -\frac{1}{\sqrt{3}}(x-6)$

$\Rightarrow -\sqrt{3}(y) = (x-6)$

$\Rightarrow -\sqrt{3}y = x-6$

dan titik potong $-\sqrt{3}y = x-6$

dan $y = \sqrt{3}x$ merupakan titik tengah antara $(6, 0)$ dan (x', y') sebut (a, b)

$\Rightarrow \sqrt{3}b + a = 6 \Rightarrow \sqrt{3}b + a = 6$

$b = a\sqrt{3} : \frac{\sqrt{3}b - 3a = 0}{4a = 6}$

$\Rightarrow a = \frac{3}{2}$

$\Rightarrow b = \frac{3}{2}\sqrt{3}$

\bullet karena titik tengah $(6, 0)$ dan (x', y') $= (\frac{3}{2}, \frac{3}{2}\sqrt{3})$

$\Rightarrow \frac{x'+6}{2} = \frac{3}{2} \Rightarrow x'+6=3 \Rightarrow x'=-3$

$\Rightarrow \frac{y'+0}{2} = \frac{3}{2}\sqrt{3} \Rightarrow y' = 3\sqrt{3}$

$\therefore x'' = -y' = -3\sqrt{3}$

$y'' = -x' = -(-3) = 3$

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o. Karena sudut putar sama

$$\Rightarrow R[S; 75^\circ] \circ R[(2,1); 165^\circ]$$

$$= R[S; (165^\circ + 75^\circ)]$$

$$= R[S; 240^\circ]$$

$$= R[(2,1); 240^\circ]$$

$$(x, y) \xrightarrow{R[(2,1); 240^\circ]} (x', y')$$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 240^\circ & -\sin 240^\circ \\ \sin 240^\circ & \cos 240^\circ \end{pmatrix} \begin{pmatrix} x-2 \\ y-1 \end{pmatrix} + \begin{pmatrix} 2 \\ 1 \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} -\frac{1}{2} & \frac{1}{2}\sqrt{3} \\ -\frac{1}{2}\sqrt{3} & -\frac{1}{2} \end{pmatrix} \begin{pmatrix} x-2 \\ y-1 \end{pmatrix} + \begin{pmatrix} 2 \\ 1 \end{pmatrix}$$

$$\Rightarrow x' = -\frac{1}{2}(x-2) + \frac{1}{2}\sqrt{3}(y-1) + 2$$

$$y' = -\frac{1}{2}\sqrt{3}(x-2) - \frac{1}{2}(y-1) + 1$$

\therefore

o Bayangan A(5,1) oleh transformasi

$$R[(2,1); 75^\circ] \circ R[(2,1); 165^\circ]$$

$$\equiv A' = \left(-\frac{1}{2}(5-2) + \frac{1}{2}\sqrt{3}(1-1) + 2, \right.$$

$$\left. -\frac{1}{2}\sqrt{3}(5-2) - \frac{1}{2}(1-1) + 1 \right)$$

$$= \left(\frac{1}{2}, 1 - \frac{3}{2}\sqrt{3} \right)$$

o Bayangan B(4,1) oleh transformasi

$$R[(2,1); 75^\circ] \circ R[(2,1); 165^\circ]$$

$$\equiv B' = \left(-\frac{1}{2}(4-2) + \frac{1}{2}\sqrt{3}(1-1) + 2, \right.$$

$$\left. -\frac{1}{2}\sqrt{3}(4-2) - \frac{1}{2}(1-1) + 1 \right)$$

$$= (1, 1 - \sqrt{3})$$

o Bayangan C(4,3) oleh transformasi

$$R[(2,1); 75^\circ] \circ R[(2,1); 165^\circ]$$

$$\equiv C' = \left(-\frac{1}{2}(4-2) + \frac{1}{2}\sqrt{3}(3-1) + 2, \right.$$

$$\left. -\frac{1}{2}\sqrt{3}(4-2) - \frac{1}{2}(3-1) + 1 \right)$$

$$= (\sqrt{3}, -\sqrt{3})$$

$$\therefore A' \left(\frac{1}{2}, 1 - \frac{3}{2}\sqrt{3} \right)$$

$$B' (1, 1 - \sqrt{3})$$

$$C' (\sqrt{3}, -\sqrt{3})$$

b). Karena transformasi yang dilakukan hanya rotasi

$$\Rightarrow \text{Luas } \triangle ABC = \text{Luas } \triangle A'B'C'$$

$$\therefore \frac{\text{Luas } \triangle ABC}{\text{Luas } \triangle A'B'C'} = 1 //$$

Uji Pemahaman Halaman 173

A. Pilihan Ganda

1. $A(0,2) \xrightarrow{T=\begin{pmatrix} 3 \\ 2 \end{pmatrix}} (x',y') \xrightarrow{M_{x+s=0}} (x'',y'')$

• $x' = 0+3 = 3 \Rightarrow x' = 3$

• $y' = 2+2 = 4 \Rightarrow y' = 4$

• $x+s=0 \Leftrightarrow x = -s \Rightarrow M_{x+s=0} = M_{x=-s}$

• $x'' = 2(-s) - x' = -10 - 3 = -13$

• $y'' = y' = 4$

\therefore Bayangan titik A = $(-13,4)$

Jawaban: B.

2. Misalkan $B'(x',y')$ merupakan bayangan titik B oleh dilatasi pusat $P(-3,4)$ dengan faktor skala 3

$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix} \begin{pmatrix} m+3 \\ n-4 \end{pmatrix} + \begin{pmatrix} -3 \\ 4 \end{pmatrix}$

$\Leftrightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 3m+9-3 \\ 3n-12+4 \end{pmatrix} = \begin{pmatrix} 3m+6 \\ 3n-8 \end{pmatrix}$

• $B'(x',y') \xrightarrow{R[(-3,4); 90^\circ]} B''(-12,-11)$

$\Rightarrow \begin{pmatrix} -12 \\ -11 \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} x'+3 \\ y'-4 \end{pmatrix} + \begin{pmatrix} -3 \\ 4 \end{pmatrix}$

$\Leftrightarrow \begin{pmatrix} -12 \\ -11 \end{pmatrix} - \begin{pmatrix} -3 \\ 4 \end{pmatrix} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 3m+6+3 \\ 3n-8-4 \end{pmatrix}$

$\Leftrightarrow \begin{pmatrix} -9 \\ -15 \end{pmatrix} = \begin{pmatrix} -3n+12 \\ 3m+9 \end{pmatrix}$

$\Rightarrow -9 = -3n+12 \Leftrightarrow 3n = 21 \Leftrightarrow n = 7$

• $-15 = 3m+9 \Leftrightarrow 3m = -24 \Leftrightarrow m = -8$

$\therefore m+n = -8+7 = -1$

Jawaban: B.

3. $C(m,n) \xrightarrow{M_y} C'(x',y') \xrightarrow{R[(2,5); 180^\circ]} C''$

• $C''(-1,13)$

$\Rightarrow x' = -m, y' = n$

$\Rightarrow \begin{pmatrix} -1 \\ 13 \end{pmatrix} = \begin{pmatrix} \cos 180^\circ & -\sin 180^\circ \\ \sin 180^\circ & \cos 180^\circ \end{pmatrix} \begin{pmatrix} x'-2 \\ y'-5 \end{pmatrix} + \begin{pmatrix} 2 \\ 5 \end{pmatrix}$

$\begin{pmatrix} -1 \\ 13 \end{pmatrix} - \begin{pmatrix} 2 \\ 5 \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} -m-2 \\ n-5 \end{pmatrix}$

$\begin{pmatrix} -3 \\ 8 \end{pmatrix} = \begin{pmatrix} m+2 \\ -n+5 \end{pmatrix}$

$\Rightarrow m+2 = -3 \Leftrightarrow m = -5$

$-n+5 = 8 \Leftrightarrow n = -3$

$\therefore m \times n = (-5)(-3) = 15$

Jawaban: E

4. $(x,y) \xrightarrow{T=\begin{pmatrix} 5 \\ -9 \end{pmatrix}} (x',y') \xrightarrow{R[(4,-1); 90^\circ]} (x'',y'')$

$\Rightarrow \begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} x'-4 \\ y'+1 \end{pmatrix} + \begin{pmatrix} 4 \\ -1 \end{pmatrix}$

$\begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x'-4 \\ y'+1 \end{pmatrix} + \begin{pmatrix} 4 \\ -1 \end{pmatrix}$

$\begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} -y'+3 \\ x'-5 \end{pmatrix}$

karena

$x' = x+s$ dan $y' = y-9$

$\Rightarrow \begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} -(y-9)+3 \\ (x+s)-5 \end{pmatrix} = \begin{pmatrix} -y+12 \\ x \end{pmatrix}$

$\Rightarrow x = y''$ dan $y = 12 - x''$

\therefore Bayangan garis $2x-3y-18=0$

$= 2y-3(12-x)-18=0$

$\Leftrightarrow 2y+3x-54=0$

$\Leftrightarrow 3x+2y-54=0$

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Jawaban: D

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5. $D[(6,0); \frac{1}{4}]$
 $(x,y) \xrightarrow{\quad} (x',y') \xrightarrow{M_y} (x'',y'')$

$\circ x' = \frac{1}{4}(x-6) + 6$

$\circ y' = \frac{1}{4}y$

$\circ x'' = -x' = -\left(\frac{1}{4}(x-6) + 6\right) = -\frac{1}{4}(x-6) - 6$

$\Leftrightarrow x'' = -\frac{1}{4}(x-6) - 6$

$\Leftrightarrow x'' + 6 = -\frac{1}{4}(x-6)$

$\Leftrightarrow -4(x'' + 6) = x - 6$

$\Leftrightarrow x = -4x'' - 24 + 6 = -4x'' - 18$

$\Leftrightarrow x = -4x'' - 18$

$\circ y'' = y' = \frac{1}{4}y \Leftrightarrow y'' = \frac{1}{4}y$

$\Leftrightarrow y = 4y''$

\Rightarrow Bayangan garis $4x + y + 24 = 0$

$= 4(-4x'' - 18) + 4y'' + 24 = 0$

$\Leftrightarrow -16x'' - 72 + 4y'' + 24 = 0$

$\Leftrightarrow 4x'' - y'' + 12 = 0$

Jawaban: B.

6. $R[(-1,1); 270^\circ]$
 $(x,y) \xrightarrow{\quad} (x',y') \xrightarrow{M_{y=-x}} (x'',y'')$

$\circ \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 270^\circ & -\sin 270^\circ \\ \sin 270^\circ & \cos 270^\circ \end{pmatrix} \begin{pmatrix} x+1 \\ y-1 \end{pmatrix} + \begin{pmatrix} -1 \\ 1 \end{pmatrix}$

$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} x+1 \\ y-1 \end{pmatrix} + \begin{pmatrix} -1 \\ 1 \end{pmatrix}$

$\Rightarrow x' = (y-1) + (-1) = y-2$

$\Leftrightarrow x' = y-2$

$\circ y' = -(x+1) + 1 = -x \Leftrightarrow y' = -x$

$\Rightarrow \circ x'' = -y' = -(-x) = x \Leftrightarrow x = x''$

$\circ y'' = -x' = -(y-2) \Leftrightarrow y = -y'' + 2$

\therefore Bayangan parabola $y = x^2 - 2x + 2$

$= -y + 2 = x^2 - 2x + 2$

$= y = -x^2 + 2x$

Jawaban: C.

7. $M_{y=-2}$
 $(x,y) \xrightarrow{\quad} (x',y') \xrightarrow{T=\begin{pmatrix} a \\ b \end{pmatrix}} (x'',y'')$

$\circ x' = x$

$\circ y' = 2(-2) - y = -4 - y$

$\circ x'' = x' + a = x + a \Leftrightarrow x = x'' - a$

$\circ y'' = y' + b = (-4 - y) + b$

$\Leftrightarrow y = -y'' - 4 + b$

\Rightarrow Bayangan $y = -3x^2 + 7x - 5$

$= -y - 4 + b = -3(x-a)^2 + 7(x-a) - 5$

$= y = 3(x-a)^2 - 7(x-a) + 5 - 4 + b$

$= y = 3x^2 - 6ax + 3a^2 - 7x + 7a + 1 + b$

$= y = 3x^2 - (6a+7)x + (3a^2+7a+1+b)$

karena pada soal juga diketahui

bayangan $y = -3x^2 + 7x - 26$ adalah

$y = 3x^2 - 13x + 11$

$\Rightarrow 13 = 6a + 7 \Leftrightarrow a = 1$

$\Rightarrow 3a^2 + 7a + 1 + b = 11$

$\Rightarrow 3 + 7 + 1 + b = 11 \Leftrightarrow b = 0$

$\therefore (a-b) = (1-0)^2$

Jawaban: D

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8. $(x, y) \xrightarrow{M_{y=x}} (x', y') \xrightarrow{R_{90^\circ}} (x'', y'')$

• $x' = y$; $y' = x$.

• $\begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} x' \\ y' \end{pmatrix}$
 $= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x' \\ y' \end{pmatrix}$

$\Rightarrow x'' = -y' = -x \Leftrightarrow x = -x''$

$y'' = x' = y \Leftrightarrow y = y''$

\therefore Bayangan garis $3x - y = -2$

$\equiv 3(-x) - y = -2 \Leftrightarrow 3x + y - 2 = 0$

Jawaban: B.

9. $(x, y) \xrightarrow{M_y} (x', y') \xrightarrow{D[(0,0); 3]} (x'', y'')$

$\Rightarrow x' = -x$ dan $y' = y$

• $x'' = 3x' = -3x \Leftrightarrow x = -\frac{1}{3}x''$

• $y'' = 3y' = 3y \Leftrightarrow y = \frac{1}{3}y''$

\therefore Bayangan kurva $y = x^2 + 3x + 3$.

$\equiv \left[\frac{1}{3}y = \left(-\frac{1}{3}x\right)^2 + 3\left(-\frac{1}{3}x\right) + 3 \right] \times 9$

$\equiv 3y = x^2 - 9x + 27$

Jawaban: D.

10. $-\frac{1}{2}\pi = -\frac{1}{2} \cdot 180^\circ = -90^\circ$

$(x, y) \xrightarrow{D[(-1,2); 3]} (x', y') \xrightarrow{R_{-90^\circ}} (x'', y'')$

• $x' = 3(x+1) + (-1) = 3x + 2$

$y' = 3(y-2) + 2 = 3y - 4$

• $\begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} \cos(-90^\circ) & -\sin(-90^\circ) \\ \sin(-90^\circ) & \cos(-90^\circ) \end{pmatrix} \begin{pmatrix} x' \\ y' \end{pmatrix}$
 $= \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} y' \\ -x' \end{pmatrix}$

$\Rightarrow x'' = y' = 3y - 4 \Leftrightarrow 3y = x'' + 4$

$\Leftrightarrow y = \frac{1}{3}(x'' + 4)$

$y'' = -x' = -(3x + 2) \Leftrightarrow 3x = -y'' - 2$

$\Leftrightarrow x = \frac{1}{3}(-y'' - 2)$

\therefore Bayangan $y = x^2 + 3$

$\equiv \frac{1}{3}(x+4) = \left(\frac{1}{3}(-y-2)\right)^2 + 3$

$\equiv \frac{3}{9}(x+4) = \frac{1}{9}(y^2 + 4y + 4) + \frac{27}{9}$

$\equiv 3x + 12 = y^2 + 4y + 31$

$\equiv 3x = y^2 + 4y + 19$

Jawaban: B.

B. Uraian

1. a. $(2, 4) \xrightarrow{R_{-90^\circ}} (x', y') \xrightarrow{T = \begin{pmatrix} 0 \\ 7 \end{pmatrix}} (x'', y'')$

• $\begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} x' \\ y' \end{pmatrix} + \begin{pmatrix} 0 \\ 7 \end{pmatrix}$
 $= \left[\begin{pmatrix} \cos(-90^\circ) & -\sin(-90^\circ) \\ \sin(-90^\circ) & \cos(-90^\circ) \end{pmatrix} \begin{pmatrix} 2 \\ 4 \end{pmatrix} \right] + \begin{pmatrix} 0 \\ 7 \end{pmatrix}$
 $= \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 2 \\ 4 \end{pmatrix} + \begin{pmatrix} 0 \\ 7 \end{pmatrix} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$

\therefore Bayangan $(2, 4)$ adalah $(4, 5)$.

b. $(-3, 4) \xrightarrow{M_{x=-2}} (x', y') \xrightarrow{R[(1,1); 90^\circ]} (x'', y'')$

• $x' = 2(-2) - (-3) = -1 \Leftrightarrow x' = -1$

• $y' = 4$

• $\begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} x' - 1 \\ y' - 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \end{pmatrix}$
 $= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} -1 - 1 \\ 4 - 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \end{pmatrix}$
 $= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} -2 \\ 3 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \end{pmatrix}$
 $= \begin{pmatrix} -2 \\ -1 \end{pmatrix}$

\therefore Bayangan $(-3, 4)$ adalah $(-2, -1)$.

Uji Pemahaman Halaman 173

$$c). (7, -6) \xrightarrow{M_y} (-7, -6) \xrightarrow{D[0; 2]} (-14, -12)$$

\therefore Bayangan $(7, -6)$ adalah $(-14, -12)$.

$$d). T = \begin{pmatrix} -3 \\ -6 \end{pmatrix} \quad M_y = -1x \quad (-3, -4) \xrightarrow{T} (-6, -10) \xrightarrow{M_y} (10, 6)$$

\therefore Bayangan $(-3, -4)$ adalah $(10, 6)$.

$$2.a). R_{180^\circ} \quad D[(0,0); 3] \quad (x, y) \xrightarrow{R_{180^\circ}} (x', y') \xrightarrow{D[(0,0); 3]} (x'', y'')$$

$$\bullet \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 180^\circ & -\sin 180^\circ \\ \sin 180^\circ & \cos 180^\circ \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\Leftrightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\Rightarrow x' = -x \text{ dan } y' = -y.$$

$$\bullet x'' = 3x' = -3x \Leftrightarrow x = -\frac{1}{3}x''$$

$$\bullet y'' = 3y' = -3y \Leftrightarrow y = -\frac{1}{3}y''$$

\therefore Bayangan garis $y = 2x - 7$

$$\equiv \left[-\frac{1}{3}y = 2\left(-\frac{1}{3}x\right) - 7 \right] \times (-3)$$

$$\Leftrightarrow y = 2x + 21$$

$$b). R[(4, -2); -270^\circ] \quad T = \begin{pmatrix} -1 \\ 2 \end{pmatrix} \quad (x, y) \xrightarrow{R[(4, -2); -270^\circ]} (x', y') \xrightarrow{T} (x'', y'')$$

$$\bullet \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos(-270^\circ) & -\sin(-270^\circ) \\ \sin(-270^\circ) & \cos(-270^\circ) \end{pmatrix} \begin{pmatrix} x-4 \\ y+2 \end{pmatrix} + \begin{pmatrix} 4 \\ -2 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x-4 \\ y+2 \end{pmatrix} + \begin{pmatrix} 4 \\ -2 \end{pmatrix}$$

$$= \begin{pmatrix} -y-2+4 \\ x-4+2 \end{pmatrix} = \begin{pmatrix} -y+2 \\ x-2 \end{pmatrix}$$

$$\bullet \begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} x' \\ y' \end{pmatrix} + \begin{pmatrix} -1 \\ 2 \end{pmatrix} = \begin{pmatrix} -y+2+(-1) \\ x-2+2 \end{pmatrix} = \begin{pmatrix} 1-y \\ x \end{pmatrix}$$

$$\Rightarrow x = y'' \text{ dan } y = 1 - x''$$

\therefore Bayangan garis $3x + 4y + 1 = 0$

$$\equiv 3y + 4(1-x) + 1 = 0 \equiv 3y - 4x + 5 = 0 //$$

$$c). (x, y) \xrightarrow{D[0; \frac{1}{3}]} (x', y') \xrightarrow{\begin{pmatrix} 2 & -1 \\ 4 & 1 \end{pmatrix}} (x'', y'')$$

$$\Rightarrow x' = 3x ; y' = 3y$$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 2 & -1 \\ 4 & 1 \end{pmatrix} \begin{pmatrix} x' \\ y' \end{pmatrix}$$

$$= \begin{pmatrix} 2x' - y' \\ 4x' + y' \end{pmatrix}$$

$$= \begin{pmatrix} 2(3x) - 3y \\ 4(3x) + 3y \end{pmatrix}$$

$$= \begin{pmatrix} 6x - 3y \\ 12x + 3y \end{pmatrix}$$

$$\Rightarrow x'' = 6x - 3y \quad \left| \begin{array}{cc|c} x & 2 & 2x'' = 12x - 6y \\ y & 1 & y'' = 12x + 3y \end{array} \right|$$

$$y'' = 12x + 3y \quad \left| \begin{array}{cc|c} x & 2 & 2x'' = 12x - 6y \\ y & 1 & y'' = 12x + 3y \end{array} \right|$$

$$x'' + y'' = 18x \quad 2x'' - y'' = -9y$$

$$\Leftrightarrow x = \frac{1}{18}(x'' + y'') \quad \Leftrightarrow y = -\frac{1}{9}(2x'' - y'')$$

\therefore Bayangan $x = 3y - 5$

$$\equiv \left[\frac{1}{18}(x+y) = 3\left(-\frac{1}{9}(2x-y)\right) - 5 \right] \times 18.$$

$$\Leftrightarrow x+y = -6(2x-y) - 90$$

$$\Leftrightarrow 13x - 5y + 90 = 0$$

$$d). T = \begin{pmatrix} -3 \\ 1 \end{pmatrix} \quad \begin{pmatrix} 0 & -3 \\ 2 & 0 \end{pmatrix} \quad (x, y) \xrightarrow{T} (x', y') \xrightarrow{\begin{pmatrix} 0 & -3 \\ 2 & 0 \end{pmatrix}} (x'', y'')$$

$$\bullet \begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} 0 & -3 \\ 2 & 0 \end{pmatrix} \begin{pmatrix} x' \\ y' \end{pmatrix}$$

$$= \begin{pmatrix} 0 & -3 \\ 2 & 0 \end{pmatrix} \begin{pmatrix} x+(-3) \\ y+1 \end{pmatrix}$$

$$\begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} -3y-3 \\ 2x-6 \end{pmatrix}$$

$$\Rightarrow y = \frac{1}{3}(-x'' - 3) ; x = \frac{1}{2}(y'' + 6)$$

\therefore Bayangan $y = 3x^2 + 6x - 5$

$$\equiv \frac{1}{3}(-x-3) = 3\left(\frac{1}{2}(y+6)\right)^2 + 6\left(\frac{1}{2}(y+6)\right) - 5$$

$$(37) \Leftrightarrow 4(-x-3) = 9(y+6)^2 + 36(y+6) - 60$$

$$\Leftrightarrow -4x = 9y^2 + 144y + 492.$$

$$3. \circ (x, y) \xrightarrow{R_{90^\circ}} (x', y')$$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -y \\ x \end{pmatrix}$$

$$\therefore (x, y) \xrightarrow{R_{90^\circ}} (-y, x).$$

◦ Jajar genjang ABCD

$$\Rightarrow \overrightarrow{AB} = \overrightarrow{DC}$$

$$\Leftrightarrow \begin{pmatrix} 7-1 \\ 2-1 \end{pmatrix} = \begin{pmatrix} x_c-2 \\ y_c-4 \end{pmatrix}$$

$$\Rightarrow x_c-2 = 7-1=6 \Leftrightarrow x_c=8$$

$$y_c-4 = 2-1=1 \Leftrightarrow y_c=5$$

$$\circ A(1,1) \xrightarrow{M_{y=-x}} (-1,-1) \xrightarrow{R_{90^\circ}} (1,-1)$$

$$\circ B(7,2) \xrightarrow{M_{y=-x}} (-2,-7) \xrightarrow{R_{90^\circ}} (7,-2)$$

$$\circ C(8,5) \xrightarrow{M_{y=x}} (-5,-8) \xrightarrow{R_{90^\circ}} (8,-5)$$

$$\circ D(2,4) \xrightarrow{R_{90^\circ} \circ M_{y=x}} (2,-4).$$

∴ Bayangan titik A = (1, -1)

◦ Bayangan titik B = (7, -2)

◦ Bayangan titik C = (8, -5)

◦ Bayangan titik D = (2, -4).

4. Misalkan A(a, b).

$$a). (a, b) \xrightarrow{M_y} (-a, b) \xrightarrow{T=\begin{pmatrix} 4 \\ -2 \end{pmatrix}} (1, -8)$$

$$\Rightarrow 1 = -a + 4 \Leftrightarrow a = 3$$

$$\circ -8 = b + (-2) \Leftrightarrow b = -6$$

$$\therefore A(3, -6).$$

$$b). \circ (a, b) \xrightarrow{D[(1,1); -1]} (x', y')$$

$$\Rightarrow \circ x' = -(a-1) + 1 = -a + 2$$

$$\circ y' = -(b-1) + 1 = -b + 2.$$

$$\circ (x', y') \xrightarrow{M_y} (3, -4)$$

$$\Rightarrow \circ 3 = -x' = -(-a + 2) = a - 2$$

$$\Leftrightarrow a = 5$$

$$\circ -4 = y' = -b + 2$$

$$\Leftrightarrow b = 6$$

$$\therefore A = (5, 6)$$

$$c). \circ (a, b) \xrightarrow{R_{45^\circ}} (x', y')$$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 45^\circ & -\sin 45^\circ \\ \sin 45^\circ & \cos 45^\circ \end{pmatrix} \begin{pmatrix} a \\ b \end{pmatrix}$$

$$= \begin{pmatrix} \frac{1}{2}\sqrt{2}a - \frac{1}{2}\sqrt{2}b \\ \frac{1}{2}\sqrt{2}a + \frac{1}{2}\sqrt{2}b \end{pmatrix}.$$

$$\circ (x', y') \xrightarrow{M_x} (-3, 0)$$

$$\Rightarrow \circ -3 = x' = \frac{1}{2}\sqrt{2}a - \frac{1}{2}\sqrt{2}b.$$

$$\Leftrightarrow -3 = \frac{1}{2}\sqrt{2}(a-b) \dots \text{Pers(1)}.$$

$$\circ 0 = -y' = -\left(\frac{1}{2}\sqrt{2}a + \frac{1}{2}\sqrt{2}b\right)$$

$$\Leftrightarrow \frac{1}{2}\sqrt{2}a = -\frac{1}{2}\sqrt{2}b$$

$$\Leftrightarrow a = -b.$$

◦ Pers (1) dan $-b = a$.

$$\Rightarrow -3 = \frac{1}{2}\sqrt{2}(a-b)$$

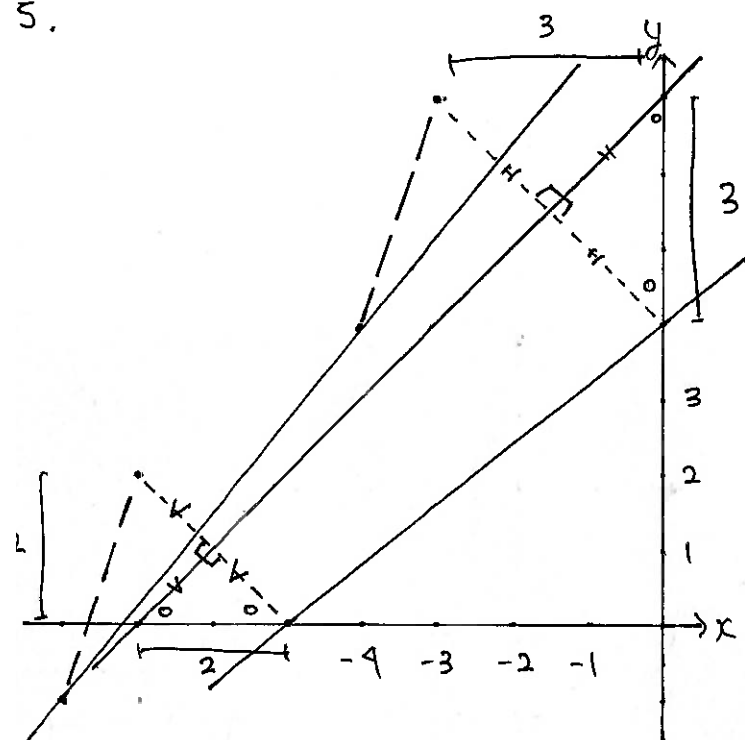
$$\Leftrightarrow -3 = \frac{1}{\sqrt{2}}(a+a).$$

$$\Leftrightarrow 2a = -3\sqrt{2}$$

$$\Leftrightarrow a = -\frac{3}{2}\sqrt{2} \Rightarrow b = \frac{3}{2}\sqrt{2}.$$

$$\therefore A\left(-\frac{3}{2}\sqrt{2}, \frac{3}{2}\sqrt{2}\right).$$

5.



• garis $y = x + 7 \Rightarrow (0, 7); (-7, 0) \in y = x + 7$

• garis $4x - 5y + 20 = 0$

$$\Leftrightarrow 4x - 5y = 4(-5)$$

$$\therefore (-5, 0); (0, 4) \in 4x - 5y + 20 = 0$$

$$\bullet (-5, 0) \xrightarrow{M_{y=x+7}} (-7, 2) \xrightarrow{T = \begin{pmatrix} -1 \\ -3 \end{pmatrix}} (-8, -1)$$

$$\bullet (0, 4) \xrightarrow{M_{y=x+7}} (-3, 7) \xrightarrow{T = \begin{pmatrix} -1 \\ -3 \end{pmatrix}} (-4, 4)$$

\therefore Bayangan garis $4x - 5y + 20 = 0$ oleh transformasi $T \circ M_{y=x+7}$

$$\equiv \frac{y - 4}{-1 - 4} = \frac{x - (-4)}{-8 - (-4)}$$

$$\Leftrightarrow \frac{y - 4}{-5} = \frac{x + 4}{-4}$$

$$\Leftrightarrow 4(y - 4) = 5(x + 4)$$

$$\Leftrightarrow 4y - 16 = 5x + 20$$

$$\Leftrightarrow 5x - 4y + 36 = 0$$

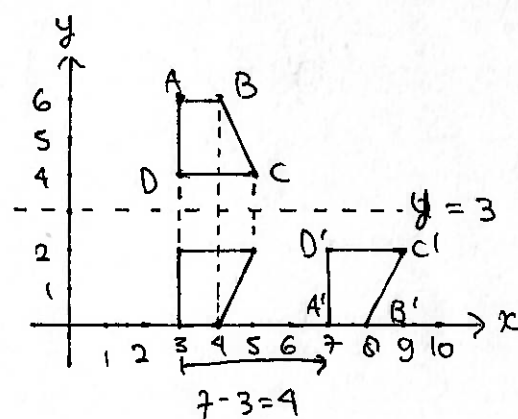
6. Titik-titik yang saling berdekatan dengan bayangannya $\hat{=}$ titik C dan D

$$\bullet \text{ Vektor } DC = \text{ Vektor } D'C'$$

\therefore Terdapat transformasi dengan $y = a$ (karena vektor DC sejajar dengan sumbu x).

tapi agar mendapatkan hasil pencerminan tersebut harus ada pergeseran setelahnya

\therefore Terdapat transformasi translasi



\therefore ABCD perlu di $M_{y=3}$ lalu dilanjutkan Translasi $T = \begin{pmatrix} 4 \\ 0 \end{pmatrix}$ untuk menghasilkan A'B'C'D'

$$\Rightarrow V = M_{y=3} \text{ dan } W \equiv T = \begin{pmatrix} 4 \\ 0 \end{pmatrix}$$

* Untuk jawaban no. 6 ada banyak dan beragam baik dari nilai atau jenis transformasi, jawaban bisa diberikan tergantung imajinasi masing-masing.

1. $\triangle PQD \xrightarrow{V} \triangle AQR$.

$\triangle AQR \xrightarrow{W} \triangle ABC$

a). • Transformasi V

Karena $AQ = QD = 3$,

$RQ = QP = \sqrt{2^2 + 1^2} = \sqrt{5}$, dan

Perpotongan RP dan AD di Q

∴ Transformasi V = Pencerminan melalui titik Q.

• Transformasi W

karena

• $\vec{AB} = \begin{pmatrix} 9 \\ 0 \end{pmatrix} = 3 \begin{pmatrix} 3 \\ 0 \end{pmatrix} = 3 \cdot \vec{AQ}$

• $\vec{AC} = \begin{pmatrix} 12 \\ 6 \end{pmatrix} = 3 \begin{pmatrix} 4 \\ 2 \end{pmatrix} = 3 \cdot \vec{AR}$

∴ Transformasi W

= Dilatasi dengan titik pusat A

faktor skalar 3.

b). $\triangle PQD \xrightarrow{M_Q} \triangle AQR$.

⇒ Luas $\triangle PQD = \text{Luas } \triangle AQR$.

• $\triangle AQR \xrightarrow{D[A; 3]} \triangle ABC$

⇒ Luas $\triangle ABC = 3^2 \cdot \text{Luas } \triangle AQR$
 $= 9 \cdot \text{Luas } \triangle AQR$

⇒ Luas BCQR

$= \text{Luas } \triangle ABC - \text{Luas } \triangle AQR$

⇒ $29 = 9 \cdot \text{Luas } \triangle AQR - 1 \cdot \text{Luas } \triangle AQR$

⇒ $29 = 8 \cdot \text{Luas } \triangle AQR$.

⇒ Luas $\triangle AQR = 3$

⇒ Luas $\triangle PQD = 3$ satuan persegi

(40)

8.a) garis OS $= \frac{y-6}{0-6} = \frac{x-6}{0-6}$

⇒ $y-6 = x-6$

⇒ $y = x$

∴ Bayangan titik

(i) E oleh translasi T

$= (6 + (-2), 2 + 5) = (4, 7)$.

(ii) D oleh pencerminan M $= (1, 4)$

(iii) C oleh transformasi T o M

$= (-4 + (-2), 2 + 5) = (-2, 7)$.

b). • Garis BC ⊥ garis FE

• Garis CA ⊥ garis FD

• Berdasarkan ukuran

$BC = FE = 2$; $AC = DF = 1$

• $\triangle DEF$ berada di bagian kanan bawah $\triangle ABC$

• Garis BC dan garis EF berpotongan di titik P(2, 2); dengan $CP = PF = 2$.

∴ Transformasi $H = R[(2, 2); -90^\circ]$

• $AP = 3 = 3 \cdot 1 = 3 \cdot FD$

• $RQ = 6 = 3 \cdot 2 = 3 \cdot FE$

∴ Transformasi V adalah dilatasi

• Misalkan titik pusat dilatasi V di O(a, b)

• karena $AP = 3 \cdot FD$ dan $RQ = 3 \cdot FE$

∴ Faktor skalar = 3

• $\vec{FR} = \begin{pmatrix} 9 \\ 2 \end{pmatrix} \Leftrightarrow \vec{OR} - \vec{OF} = \begin{pmatrix} 9 \\ 2 \end{pmatrix}$

Faktor skalar = 3 ⇒ $3\vec{OF} - \vec{OF} = \begin{pmatrix} 9 \\ 2 \end{pmatrix}$

⇒ $2\vec{OF} = \begin{pmatrix} 9 \\ 2 \end{pmatrix}$

⇒ $2 \begin{pmatrix} 9-a \\ 2-b \end{pmatrix} = \begin{pmatrix} 9 \\ 2 \end{pmatrix} \Leftrightarrow \begin{cases} a=2 \\ b=1 \end{cases}$

∴ Transformasi V = $D[(2, 1); 3]$

Uji Pemahaman Halaman 173

9a). Berdasarkan bentuk

$$A \rightarrow E, B \rightarrow F, C \rightarrow G, D \rightarrow H$$

$$\circ AB \perp FE$$

$$\circ CB \perp GF$$

• Perpotongan CB dan GF di titik $P(2,0)$.

$$\circ PC = PG, PB = PF,$$

$$PA = PE = \sqrt{4^2 + 3^2} = 5,$$

$$PD = PH = \sqrt{3^2 + 2^2} = \sqrt{13}.$$

• Rotasi R searah jarum jam

$$\Rightarrow R[(2,0); -(360-90)^\circ]$$

$$= R[(2,0); -270^\circ]$$

b). (i) Berdasarkan bentuk

$$E \rightarrow P, F \rightarrow Q, G \rightarrow R, H \rightarrow S$$

$$\circ SP = 6 = 3 \cdot 2 = 3 HE$$

$$\circ PQ = 9 = 3 \cdot 3 = 3 EF$$

$$\circ QR = 3 = 3 \cdot 1 = 3 FG$$

$$\circ RS = \sqrt{3^2 + 9^2} =$$

$$= \sqrt{3^2(1^2 + 3^2)}$$

$$= 3\sqrt{1^2 + 3^2}$$

$$= 3 GH$$

$$\therefore \text{Transformasi } V = D[H; 3]$$

$$\circ \vec{HS} = \begin{pmatrix} -1 \\ -3 \end{pmatrix}$$

$$\therefore \text{Transformasi } W \equiv T = \begin{pmatrix} -1 \\ -3 \end{pmatrix}$$

* Jawaban b(i) beragam dilihat dari nilai dan urutan yang sesuai.

$$(ii). EFGH \xrightarrow{T = D[H; 3]} PQRS$$

$$\Rightarrow \text{Luas PQRS} = 3^2 \times \text{Luas EFGH} \\ = 9 \times \text{Luas EFGH}$$

• Luas arsiran pada trapesium PQRS

$$= \text{Luas PQRS} - \text{Luas EFGH}$$

$$\Leftrightarrow 36 = 9 \times \text{Luas EFGH} - 1 \times \text{Luas EFGH}$$

$$\Leftrightarrow 36 = 8 \times \text{Luas EFGH}$$

$$\therefore \text{Luas EFGH} = 4,5 \text{ satuan luas.}$$

10. Pencerminkan suatu fungsi kuadrat oleh $y = x - 4$

= menggeser grafik fungsi kuadrat tersebut sebanyak 4 satuan ke kiri
lalu mencerminkan hasil pergeseran tersebut dengan garis $y = x$
lalu hasil pencerminan tersebut digeser kembali sebanyak 4 satuan ke kanan.

$$a) \circ y = (x-2)^2 \text{ geser ke kiri 4 satuan}$$

$$\equiv y = ((x+4)-2)^2 =$$

$$\equiv y = (x+2)^2.$$

$$\circ y = x - 4 \text{ geser ke kiri 4 satuan}$$

$$\equiv y = (x+4) - 4$$

$$\equiv y = x.$$

$$\circ y = (x+2)^2 \xrightarrow{My=x} x = (y+2)^2$$

$$\circ x = (y+2)^2 \text{ geser ke kanan 4 satuan}$$

$$\Leftrightarrow x - 4 = (y+2)^2$$

Uji Pemahaman Halaman 173

$$\therefore y = x^2 - 4x + 4 \xrightarrow{M, y = x - 4} x - 4 = (y + 2)^2$$

$$\circ (x, y) \xrightarrow{T = \begin{pmatrix} 2 \\ -7 \end{pmatrix}} (x', y'), \text{ dimana}$$

$$x' = x + 2 (\Leftrightarrow) x = x' - 2.$$

$$y' = y - 7 (\Leftrightarrow) y = y' + 7$$

\therefore Bayangan garis $x - 4 = (y - 2)^2$ oleh translasi $\begin{pmatrix} 2 \\ -7 \end{pmatrix}$

$$\equiv (x - 2) - 4 = ((y + 7) + 2)^2$$

$$\Leftrightarrow x - 6 = (y + 9)^2$$

$$\therefore y = x^2 - 4x + 4 \xrightarrow{T \circ M} x - 6 = (y + 9)^2 //$$

b). $(x, y) \xrightarrow{T = \begin{pmatrix} 2 \\ -7 \end{pmatrix}} (x', y') \text{ dimana.}$

$$x' = x + 2 (\Leftrightarrow) x = x' - 2.$$

$$y' = y - 7 (\Leftrightarrow) y = y' + 7.$$

\Rightarrow Bayangan garis $y = (x - 2)^2$ oleh translasi $\begin{pmatrix} 2 \\ -7 \end{pmatrix}$

$$\equiv y + 7 = ((x - 2) - 2)^2$$

$$\Leftrightarrow y + 7 = (x - 4)^2.$$

\circ Pergeseran $y + 7 = (x - 4)^2$ ke kiri

$$4 \text{ satuan} \equiv y + 7 = x^2.$$

$$\circ y + 7 = x^2 \xrightarrow{M, y = x} x + 7 = y^2.$$

\circ Pergeseran $x + 7 = y^2$ ke kanan

$$4 \text{ satuan} \equiv (x - 4) + 7 = y^2$$

$$\Leftrightarrow x = y^2 - 3.$$

$$\therefore y = (x - 2)^2 \xrightarrow{M \circ T} x = y^2 - 3.$$

Soal Pendalaman Halaman 147

$$A(\sqrt{2}, \sqrt{2}) \xrightarrow{R[(0,0); 135^\circ]} A'(x', y')$$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 135^\circ & -\sin 135^\circ \\ \sin 135^\circ & \cos 135^\circ \end{pmatrix} \begin{pmatrix} \sqrt{2} \\ \sqrt{2} \end{pmatrix}$$

$$= \begin{pmatrix} -\frac{1}{2}\sqrt{2} & -\frac{1}{2}\sqrt{2} \\ \frac{1}{2}\sqrt{2} & -\frac{1}{2}\sqrt{2} \end{pmatrix} \begin{pmatrix} \sqrt{2} \\ \sqrt{2} \end{pmatrix}$$

$$= \begin{pmatrix} -1 & -1 \\ 1 & -1 \end{pmatrix} = \begin{pmatrix} -2 \\ 0 \end{pmatrix}$$

$$\therefore A'(-2, 0).$$

Jawaban: A.

Soal Pendalaman Halaman 156

$$(x, y) \xrightarrow{O[(0,0); 2]} (x', y')$$

$$\bullet x' = 2x \Leftrightarrow x = \frac{1}{2}x'$$

$$\bullet y' = 2y \Leftrightarrow y = \frac{1}{2}y'$$

$$\Rightarrow \text{Bayangan } y = x^3 \text{ oleh } O[(0,0); 2]$$

$$= \frac{1}{2}y' = \left(\frac{1}{2}x'\right)^3$$

$$\Leftrightarrow \frac{1}{2}y' = \frac{1}{8}x'^3$$

$$\Leftrightarrow y' = \frac{1}{4}x'^3$$

Jawaban: A.

Latihan Soal Akhir Bab 3

1) $H = K + T$

$$T = H - K$$

$$= \begin{pmatrix} -1 \\ 2 \end{pmatrix} - \begin{pmatrix} 4 \\ 5 \end{pmatrix} = \begin{pmatrix} -5 \\ -3 \end{pmatrix}$$

Jawaban: B

2) Bayangan garis AB oleh pencerminan

pada AC adalah garis AF

Jawaban: C

3) Bayangan titik M oleh cermin PQ adalah titik B

Jawaban: B

4) Salah satu titik di garis PQ adalah $(3, 4)$ dan $(0, 1)$

maka garis PQ

$$\Rightarrow \frac{x-0}{3-0} = \frac{y-1}{4-1}$$

$$\frac{x}{3} = \frac{y-1}{3}$$

$$x = y - 1$$

$$y = x + 1$$

Jawaban: D

5) Matriks $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ bersesuaian dengan

transformasi pencerminan terhadap

garis $y = x$

Jawaban: C

6. Pers. $3x + 2y + 5 = 0$

$$A(x, y) \xrightarrow{x=h} A' \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 2h-x \\ y \end{pmatrix}$$

$$(x, y) \xrightarrow{x=1} (2-x, y)$$

$$\Rightarrow x' = 2 - x \quad y' = y$$

$$x = 2 - x'$$

$$\Rightarrow 3(2 - x') + 2y' + 5 = 0$$

$$6 - 3x' + 2y' + 5 = 0$$

$$-3x' + 2y' = -11$$

$$3x - 2y = 11 \quad \leftarrow \text{Pers. bayangan}$$

Jawaban: A

7. Titik-titik pada segitiga A

$$(-4, 5), (-4, 7), (-5, 7)$$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 180 & -\sin 180 \\ \sin 180 & \cos 180 \end{pmatrix} \begin{pmatrix} x - a \\ y - b \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix}$$

$$= \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} x + 1 \\ y - 4 \end{pmatrix} + \begin{pmatrix} -1 \\ 4 \end{pmatrix}$$

$$= \begin{pmatrix} -x - 1 \\ -y + 4 \end{pmatrix} + \begin{pmatrix} -1 \\ 4 \end{pmatrix}$$

$$= \begin{pmatrix} -x - 2 \\ -y + 8 \end{pmatrix}$$

$$\text{Bayangan titik } (-4, 5) \Rightarrow (2, 3)$$

$$(-4, 7) \Rightarrow (2, 1)$$

$$(-5, 7) \Rightarrow (3, 1)$$

\therefore Bayangan ΔA adalah ΔD

Jawaban: C

8. $(x, y) \xrightarrow{R(a, b, -90^\circ)} (x', y')$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} x-a \\ y-b \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix}$$

$$\begin{pmatrix} 4 \\ 7 \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 3-a \\ -b \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix}$$

$$\begin{pmatrix} 4 \\ 7 \end{pmatrix} = \begin{pmatrix} -b \\ -3+a \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix}$$

$$\begin{aligned} \Rightarrow a-b &= 4 & \Rightarrow 7-b &= 4 \\ a+b &= 10 & -b &= -3 \\ \hline 2a &= 14 & b &= 3 \\ a &= 7 & & \end{aligned}$$

$\therefore P(a, b) = P(7, 3)$

Jawaban: D

9. $L \equiv x^2 + y^2 - 8x + 6y = 0$

$R(0; -90^\circ)$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} y \\ -x \end{pmatrix}$$

$$\begin{aligned} x' &= y \\ -y' &= x \end{aligned}$$

$$\begin{aligned} \Rightarrow L' &\equiv (-y')^2 + (x')^2 - 8(-y') + 6(x') = 0 \\ (y')^2 + (x')^2 + 8y' + 6x' &= 0 \end{aligned}$$

\therefore Pers. bayangan L adalah $y^2 + x^2 + 8y + 6x = 0$

Jawaban: A

10. $B = (0, 2) \rightarrow B' = (0, 6)$

$C = (1, 2) \rightarrow C' = (3, 6)$

$D = (2, 1) \rightarrow D' = (6, 3)$

$E = (2, 0) \rightarrow E' = (6, 0)$

$\therefore K$ adalah 3

Jawaban: D

11. $A'B'C' = 3 \cdot ABC$

\Rightarrow faktor skalar dilatasi $= k = 3$

$$\begin{aligned} \begin{pmatrix} x' \\ y' \end{pmatrix} &= \begin{pmatrix} k & 0 \\ 0 & k \end{pmatrix} \begin{pmatrix} x-a \\ y-b \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix} \\ &= \begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix} \begin{pmatrix} x-a \\ y-b \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix} \\ &= \begin{pmatrix} 3x-3a \\ 3y-3b \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix} \end{aligned}$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 3x-2a \\ 3y-2b \end{pmatrix}$$

Titik A & A'

$$\begin{pmatrix} 2 \\ 7 \end{pmatrix} = \begin{pmatrix} 3(4)-2a \\ 3(7)-2b \end{pmatrix}$$

$$\begin{aligned} \Rightarrow 2 &= 12-2a & \Rightarrow 7 &= 21-2b \\ 2a &= 10 & 2b &= 14 \\ a &= 5 & b &= 7 \end{aligned}$$

\therefore Koordinat pusat dilatasi $(a, b) = (5, 7)$

Jawaban: C

12] $A \xrightarrow{D(p;4)} A'$

$(-3, 7) \xrightarrow{D(p;4)} (-3, 22)$

$$\begin{pmatrix} -3 \\ 22 \end{pmatrix} = \begin{pmatrix} 4 & 0 \\ 0 & 4 \end{pmatrix} \begin{pmatrix} -3-a \\ 7-b \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix}$$

$$= \begin{pmatrix} -12-4a \\ 28-4b \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix}$$

$\Rightarrow -3 = -12 - 4a + a$

$9 = -3a$

$-3 = a$

$\Rightarrow 22 = 28 - 4b + b \quad \therefore p = (a, b)$

$-6 = -3b \quad = (-3, 2)$

$2 = b$

Jawaban : A

13] $\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} 3 \\ 2 \end{pmatrix}$

$$= \begin{pmatrix} 3 \\ -2 \end{pmatrix}$$

Jawaban : E

14] $\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$

$$= \begin{pmatrix} y \\ -x \end{pmatrix}$$

$x' = y$

$-y' = x$

Peta $\Rightarrow (-y')^2 + (x')^2 - 3(-y') + 5(x') + 9 = 0$

$y^2 + x^2 + 3y + 5x + 9 = 0$

Jawaban : D

15] $\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 1 & 2 \\ 3 & -5 \end{pmatrix} \begin{pmatrix} 7 \\ 6 \end{pmatrix}$

$$= \begin{pmatrix} 7 + 12 \\ 21 - 30 \end{pmatrix}$$

$$= \begin{pmatrix} 19 \\ -9 \end{pmatrix}$$

Jawaban : A

16] $y = 2x^2 + 12x + 23$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} -x \\ y \end{pmatrix}$$

$x = -x'$

$y = y'$

Pers. bayangan : $y' = 2(-x')^2 + 12(-x') + 23$

$y' = 2(x')^2 - 12x' + 23$

$\Rightarrow y = 2x^2 - 12x + 23$

$y = 2x^2 - 12x + 18 + 5$

$y - 5 = 2(x^2 - 6x + 9)$

$y - 5 = 2(x - 3)^2$

Jawaban : C

17] $3x + 4y - 12 = 0$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 3 & 0 \\ -1 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} 3x \\ -x + y \end{pmatrix}$$

$\Rightarrow x' = 3x \quad \Rightarrow y' = -x + y$

$\frac{1}{3}x' = x \quad y' + \frac{1}{3}x' = y$

$\Rightarrow 3\left(\frac{1}{3}x'\right) + 4\left(y' + \frac{1}{3}x'\right) - 12 = 0$

$x' + 4y' + \frac{4}{3}x' - 12 = 0$

$\frac{7}{3}x' + 4y' - 12 = 0$

$7x + 12y - 36 = 0$

Jawaban : B

18) $y = 2x - 5$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\begin{aligned} \begin{pmatrix} x \\ y \end{pmatrix} &= \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}^{-1} \begin{pmatrix} x' \\ y' \end{pmatrix} \\ &= \frac{1}{8-3} \begin{pmatrix} 4 & -3 \\ -1 & 2 \end{pmatrix} \begin{pmatrix} x' \\ y' \end{pmatrix} \\ &= \frac{1}{5} \begin{pmatrix} 4x' - 3y' \\ -x' + 2y' \end{pmatrix} \end{aligned}$$

$\Rightarrow y = 2x - 5$

$$\frac{1}{5}(-x' + 2y') = \frac{2}{5}(4x' - 3y') - 5$$

$$-x' + 2y' = 8x' - 6y' - 25$$

$$0 = 9x' - 8y' - 25$$

\therefore Pers bayangan: $9x - 8y - 25 = 0$

Jawaban: A

19)
$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 3 & 1 \\ 1 & 2 \end{pmatrix} \begin{pmatrix} -2 \\ 5 \end{pmatrix}$$

$$= \begin{pmatrix} -6 + 5 \\ -2 + 10 \end{pmatrix}$$

$$= \begin{pmatrix} -1 \\ 8 \end{pmatrix}$$

Jawaban: D

20) $A(2,3) \Rightarrow A'(3,2)$
 $B(-4,-5) \Rightarrow B'(-5,-4)$

$$(x,y) \Rightarrow (y,x)$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} y \\ x \end{pmatrix}$$

$$= \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

Jawaban: D

21) $2x + 5y = 10$

$$T_1 = \begin{pmatrix} -1 \\ 4 \end{pmatrix}, T_2 = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$$

$$\Rightarrow T_2 \circ T_1 = \begin{pmatrix} -3-1 \\ 2+4 \end{pmatrix} = \begin{pmatrix} -4 \\ 6 \end{pmatrix}$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} -4 \\ 6 \end{pmatrix} + \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\Rightarrow x' + 4 = x$$

$$y' - 6 = y$$

$$2(x' + 4) + 5(y' - 6) = 10$$

$$2x' + 8 + 5y' - 30 = 10$$

$$2x' + 5y' = 32$$

Jawaban: E

22) $T_2 \circ T_1 = \begin{pmatrix} -2+5 \\ 3-6 \end{pmatrix} = \begin{pmatrix} 3 \\ -3 \end{pmatrix}$

$$(3,6) \xrightarrow{T_2 \circ T_1} (3+3, 6-3)$$

$$\therefore (T_2 \circ T_1)(3,6) \text{ adalah } (6,3)$$

Jawaban: A

23) Salah satu titik $P \rightarrow (-3,1)$

$$T \rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} -3 \\ 1 \end{pmatrix} + \begin{pmatrix} 2 \\ -4 \end{pmatrix} = \begin{pmatrix} -1 \\ -3 \end{pmatrix}$$

$$M \rightarrow \begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x' \\ y' \end{pmatrix}$$

$$= \begin{pmatrix} -x' \\ y' \end{pmatrix}$$

$$= \begin{pmatrix} 1 \\ -3 \end{pmatrix}$$

Gambar yang memiliki titik $(1,-3)$

adalah gambar A

Jawaban: A

24 Titik-titik pada G
 $\Rightarrow (-1, 3), (-1, 4), (-2, 5), (-2, 3)$

$\Rightarrow M_{x=2}$, titik $(-1, 3)$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 2h-x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} 2(2) - (-1) \\ 3 \end{pmatrix} = \begin{pmatrix} 4+1 \\ 3 \end{pmatrix} = \begin{pmatrix} 5 \\ 3 \end{pmatrix}$$

$\Rightarrow T = \begin{pmatrix} -3 \\ 3 \end{pmatrix}$

$$\begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} x' \\ y' \end{pmatrix} + T$$

$$= \begin{pmatrix} 5 \\ 3 \end{pmatrix} + \begin{pmatrix} -3 \\ 3 \end{pmatrix} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$$

\Rightarrow Gambar yang mempunyai titik $(2, 6)$ adalah gambar A

Jawaban : A

25 Bayangan A $(2, -1)$ oleh $M \circ T$

$\Rightarrow T = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 2+3 \\ -1-2 \end{pmatrix} = \begin{pmatrix} 5 \\ -3 \end{pmatrix}$$

$\Rightarrow M_{y=-x}$

$$\begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} -y' \\ -x' \end{pmatrix} = \begin{pmatrix} -(-3) \\ -(5) \end{pmatrix} = \begin{pmatrix} 3 \\ -5 \end{pmatrix}$$

$\therefore A(2, -1) \xrightarrow{M \circ T} A'(-5, 3)$

Jawaban : E

26 $M_1 \circ M_2 (2, 3)$
$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 2h-x \\ y \end{pmatrix}$$

$\Rightarrow (2, 3) \xrightarrow{M_{x=11}} (20, 3)$

$\Rightarrow (20, 3) \xrightarrow{M_{x=6}} (-8, 3)$

$\therefore (2, 3) \xrightarrow{M_1 \circ M_2} (-8, 3)$

Jawaban : A

27
$$\begin{pmatrix} x' \\ y' \end{pmatrix} = (R_{90^\circ} \circ M_x) \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} y \\ x \end{pmatrix}$$

$x' = y ; y' = x$

$\Rightarrow y = 3x + 4$

Pers. bayangan oleh $(R_{90^\circ} \circ M_x)$

$x' = 3(y') + 4$

$x - 3y - 4 = 0$

Jawaban : D

28
$$\begin{pmatrix} x' \\ y' \end{pmatrix} = (M_x \circ R_{90^\circ}) \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} -y \\ -x \end{pmatrix}$$

$y = -x'$

$x = -y'$

$\Rightarrow y = -3x + 1$

Pers. bayangan oleh $(M_x \circ R_{90^\circ})$

$-x' = -3(-y') + 1$

$-x' = 3y' + 1$

$3y = -x - 1$

Jawaban : B

29) garis $4x - 3y + 2 = 0$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = (R_{90^\circ} \circ M_{y=x}) \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} -x \\ y \end{pmatrix}$$

$$x' = -x \rightarrow -x' = x$$

$$y' = y$$

$$\Rightarrow 4(-x') - 3(y') + 2 = 0$$

$$\frac{-4x' - 3y' + 2 = 0}{4x + 3y - 2 = 0} \cdot (-1)$$

Jawaban : B

30) $(4, 8) \xrightarrow{M_{x=6}} (2(6) - 4, -8)$

$(4, 8) \xrightarrow{M_{x=6}} (8, 8)$

$$\Rightarrow \begin{pmatrix} x'' \\ y'' \end{pmatrix} = R_{0,60^\circ} \begin{pmatrix} x' \\ y' \end{pmatrix}$$

$$= \begin{pmatrix} \cos 60 & -\sin 60 \\ \sin 60 & \cos 60 \end{pmatrix} \begin{pmatrix} 8 \\ -8 \end{pmatrix}$$

$$= \begin{pmatrix} \frac{1}{2} & -\frac{1}{2}\sqrt{3} \\ \frac{1}{2}\sqrt{3} & \frac{1}{2} \end{pmatrix} \begin{pmatrix} 8 \\ -8 \end{pmatrix}$$

$$= \begin{pmatrix} 4 + 4\sqrt{3} \\ 4\sqrt{3} - 4 \end{pmatrix}$$

Jawaban : D

31) $\begin{pmatrix} x' \\ y' \end{pmatrix} = (M_x \circ R_{135^\circ}) \begin{pmatrix} x \\ y \end{pmatrix}$

$$= \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} \cos 135 & -\sin 135 \\ \sin 135 & \cos 135 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} -\frac{1}{2}\sqrt{2} & -\frac{1}{2}\sqrt{2} \\ \frac{1}{2}\sqrt{2} & -\frac{1}{2}\sqrt{2} \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} -\frac{1}{2}\sqrt{2} & -\frac{1}{2}\sqrt{2} \\ -\frac{1}{2}\sqrt{2} & \frac{1}{2}\sqrt{2} \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\begin{pmatrix} 0 \\ -2 \end{pmatrix} = \begin{pmatrix} -\frac{1}{2}\sqrt{2}x - \frac{1}{2}\sqrt{2}y \\ -\frac{1}{2}\sqrt{2}x + \frac{1}{2}\sqrt{2}y \end{pmatrix}$$

$$\Rightarrow -\frac{1}{2}\sqrt{2}x - \frac{1}{2}\sqrt{2}y = 0$$

$$\frac{-\frac{1}{2}\sqrt{2}x + \frac{1}{2}\sqrt{2}y = -2}{- \sqrt{2}y = 2}$$

$$y = -\sqrt{2}$$

$$x = \sqrt{2}$$

$$\therefore (x, y) = (\sqrt{2}, -\sqrt{2})$$

Jawaban : C

32) $\Rightarrow M_1 \Rightarrow M_{(x=1)} \text{ titik } (-1, 3)$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 2h - x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} 2 - (-1) \\ 3 \end{pmatrix}$$

$$= \begin{pmatrix} 3 \\ 3 \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} \cos 45 & -\sin 45 \\ \sin 45 & \cos 45 \end{pmatrix} \begin{pmatrix} x' \\ y' \end{pmatrix}$$

$$= \begin{pmatrix} \frac{1}{2}\sqrt{2} & -\frac{1}{2}\sqrt{2} \\ \frac{1}{2}\sqrt{2} & \frac{1}{2}\sqrt{2} \end{pmatrix} \begin{pmatrix} 3 \\ 3 \end{pmatrix}$$

$$= \begin{pmatrix} \frac{3}{2}\sqrt{2} - \frac{3}{2}\sqrt{2} \\ \frac{3}{2}\sqrt{2} + \frac{3}{2}\sqrt{2} \end{pmatrix}$$

$$= \begin{pmatrix} 0 \\ 3\sqrt{2} \end{pmatrix}$$

Jawaban : C

33. $y = x^2 - 4px + 5p^2$

$$(x_p, y_p) = \left(\frac{-b}{2a}, \frac{b^2 - 4ac}{-4a} \right)$$

$$\Rightarrow x_p = \frac{-b}{2a} = \frac{4p}{2} = 2p$$

$$y_p = \frac{b^2 - 4ac}{-4a} = \frac{16p^2 - 4(5p^2)}{-4} = \frac{16p^2 - 20p^2}{-4} = p^2$$

$$\begin{aligned} \Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} &= (M_x \circ R_{(0;90^\circ)}) \begin{pmatrix} x \\ y \end{pmatrix} \\ &= \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \\ &= \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \\ &= \begin{pmatrix} -y \\ -x \end{pmatrix} \\ &= \begin{pmatrix} -p^2 \\ -2p \end{pmatrix} \end{aligned}$$

Jawaban: A

34.
$$\begin{aligned} \begin{pmatrix} x' \\ y' \end{pmatrix} &= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \end{pmatrix} \\ &= \begin{pmatrix} 0 & -2 \\ 2 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \end{pmatrix} \\ &= \begin{pmatrix} -2 \\ 2 \end{pmatrix} \end{aligned}$$

Jawaban: C

35.
$$\begin{aligned} T_2 \circ T_1 &= \begin{pmatrix} 1 & 2 \\ 4 & 3 \end{pmatrix} \begin{pmatrix} 3 & -1 \\ 2 & 4 \end{pmatrix} \\ &= \begin{pmatrix} 3+8 & -1+8 \\ 12+12 & -4+12 \end{pmatrix} \\ &= \begin{pmatrix} 11 & 7 \\ 24 & 8 \end{pmatrix} \end{aligned}$$

Jawaban: C

B. Uraian

11 a.) $(4, -3) \xrightarrow{T: \begin{pmatrix} -1 \\ 5 \end{pmatrix}} (4-1, -3+5)$

$$(4, -3) \xrightarrow{T: \begin{pmatrix} -1 \\ 5 \end{pmatrix}} (3, 2)$$

\therefore Bayangannya $(3, 2)$

b.) $(-5, 1) \xrightarrow{T: \begin{pmatrix} 3 \\ -7 \end{pmatrix}} (-5+3, 1-7)$

$$(-5, 1) \xrightarrow{T: \begin{pmatrix} 3 \\ -7 \end{pmatrix}} (-2, -6)$$

\therefore Bayangannya $(-2, -6)$

2. Refleksi $x=3$, $\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 2h-x \\ y \end{pmatrix}$

a.) $(4, 1)$ dan garis $x=3$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 2(3) - 4 \\ 1 \end{pmatrix} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$$

$\therefore (x', y') = (2, 1)$

b.) $(-2, 5)$ dan garis $x=-5$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 2(-5) - (-2) \\ 5 \end{pmatrix} = \begin{pmatrix} -10 + 2 \\ 5 \end{pmatrix} = \begin{pmatrix} -8 \\ 5 \end{pmatrix}$$

$\therefore (x', y') = (-8, 5)$

refleksi $y=k$, $\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} x \\ 2k-y \end{pmatrix}$

c.) $(7, -2)$ dan garis $y=2$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 7 \\ 2(2) - (-2) \end{pmatrix} = \begin{pmatrix} 7 \\ 6 \end{pmatrix}$$

$\therefore (x', y') = (7, 6)$

d.) $(-8, 4)$ dan garis $y=-4$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} -8 \\ 2(-4) - 4 \end{pmatrix} = \begin{pmatrix} -8 \\ -12 \end{pmatrix}$$

$\therefore (x', y') = (-8, -12)$

e.) $(7, 2)$ dan garis $y = x$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} y \\ x \end{pmatrix} \\ = \begin{pmatrix} 2 \\ 7 \end{pmatrix}$$

∴ Bayangannya $(2, 7)$

f.) $(4, -6)$ dan garis $y = -x$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} -y \\ -x \end{pmatrix} \\ = \begin{pmatrix} -(-6) \\ -4 \end{pmatrix} = \begin{pmatrix} 6 \\ -4 \end{pmatrix}$$

∴ Bayangannya $(6, -4)$

13 Rotasi :

a.) $(2, 5)$ dan R_{90°

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} 2 \\ 5 \end{pmatrix} \\ = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 2 \\ 5 \end{pmatrix} \\ = \begin{pmatrix} -5 \\ 2 \end{pmatrix}$$

b.) $(-4, 2)$ dan R_{180°

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 180^\circ & -\sin 180^\circ \\ \sin 180^\circ & \cos 180^\circ \end{pmatrix} \begin{pmatrix} -4 \\ 2 \end{pmatrix} \\ = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} -4 \\ 2 \end{pmatrix} \\ = \begin{pmatrix} 4 \\ -2 \end{pmatrix}$$

∴ Bayangannya adalah $(4, -2)$

c.) $(4, -7)$ dan R_{-90°

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos(-90^\circ) & -\sin(-90^\circ) \\ \sin(-90^\circ) & \cos(-90^\circ) \end{pmatrix} \begin{pmatrix} 4 \\ -7 \end{pmatrix} \\ = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 4 \\ -7 \end{pmatrix} \\ = \begin{pmatrix} -7 \\ -4 \end{pmatrix}$$

∴ $(4, -7) \xrightarrow{R(0; 90^\circ)} (-7, -4)$

d.) $(2, 2)$ dan R_{45°

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 45^\circ & -\sin 45^\circ \\ \sin 45^\circ & \cos 45^\circ \end{pmatrix} \begin{pmatrix} 2 \\ 2 \end{pmatrix} \\ = \begin{pmatrix} \frac{1}{2}\sqrt{2} & -\frac{1}{2}\sqrt{2} \\ \frac{1}{2}\sqrt{2} & \frac{1}{2}\sqrt{2} \end{pmatrix} \begin{pmatrix} 2 \\ 2 \end{pmatrix} \\ = \begin{pmatrix} \sqrt{2} - \sqrt{2} \\ \sqrt{2} + \sqrt{2} \end{pmatrix} \\ = \begin{pmatrix} 0 \\ 2\sqrt{2} \end{pmatrix}$$

∴ $(2, 2) \xrightarrow{R(0; 90^\circ)} (0, 2\sqrt{2})$

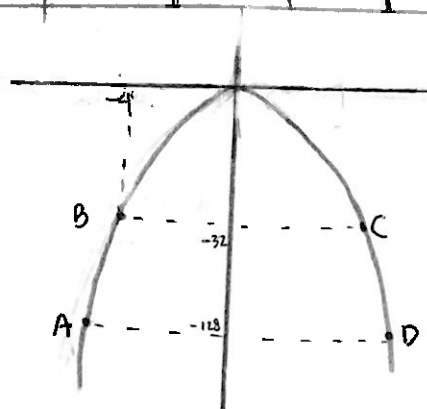
e.) $(7, -4\sqrt{3})$ dan R_{60°

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 60^\circ & -\sin 60^\circ \\ \sin 60^\circ & \cos 60^\circ \end{pmatrix} \begin{pmatrix} 7 \\ -4\sqrt{3} \end{pmatrix} \\ = \begin{pmatrix} \frac{1}{2} & -\frac{1}{2}\sqrt{3} \\ \frac{1}{2}\sqrt{3} & \frac{1}{2} \end{pmatrix} \begin{pmatrix} 7 \\ -4\sqrt{3} \end{pmatrix} \\ = \begin{pmatrix} \frac{7}{2} + 2\sqrt{3} \\ \frac{7}{2}\sqrt{3} - 2\sqrt{3} \end{pmatrix} \\ = \begin{pmatrix} \frac{19}{2} \\ \frac{3}{2}\sqrt{3} \end{pmatrix}$$

∴ $(7, -4\sqrt{3}) \xrightarrow{R(0; 60^\circ)} \left(\frac{19}{2}, \frac{3}{2}\sqrt{3}\right)$

4 a) $y = -2x^2$

Titik	A	B	O	C	D
x	-8	-4	0	4	8
y	-128	-32	0	-32	-128
(x,y)	(-8,-128)	(-4,-32)	(0,0)	(4,-32)	(8,-128)



b.) A, B, O, C, D di dilatasi $D[0; \frac{1}{4}]$

$$A' = (-2, -32) \quad C' = (1, -8)$$

$$B' = (-1, -8) \quad D' = (2, -32)$$

$$O' = (0, 0)$$

c.) Persamaan bayangan :

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \frac{1}{4} & 0 \\ 0 & \frac{1}{4} \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} \frac{1}{4}x \\ \frac{1}{4}y \end{pmatrix}$$

$$\Rightarrow x' = \frac{1}{4}x \quad \Rightarrow \frac{1}{4}y = y'$$

$$4x' = x \quad y = 4y'$$

$$\Rightarrow 4y' = -2(4x')^2$$

$$4y' = -2(16(x')^2)$$

$$y' = -8(x')^2$$

$$y = -8x^2$$

$$\therefore y = -2x^2 \xrightarrow{D[0; \frac{1}{4}]} y = -8x^2$$

5 a) $4x + 11y = 44$ oleh R_{90°

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -y \\ x \end{pmatrix} \Rightarrow \begin{matrix} x' = -y \\ -x' = y \end{matrix}$$

$$\Rightarrow 4(y') + 11(-x') = 44$$

$$4y' - 11x' = 44$$

$$\therefore 4x + 11y = 44 \xrightarrow{R_{90^\circ}} 4y - 11x = 44$$

b.) $x^2 + y^2 = 9$ oleh $T = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 4 + x \\ -3 + y \end{pmatrix}$$

$$\Rightarrow x' = 4 + x \quad \Rightarrow y' = -3 + y$$

$$x' - 4 = x \quad y' + 3 = y$$

$$\Rightarrow (x' - 4)^2 + (y' + 3)^2 = 9$$

$$x^2 + y^2 = 9 \xrightarrow{T = \begin{pmatrix} 4 \\ -3 \end{pmatrix}} (x - 4)^2 + (y + 3)^2 = 9$$

c.) $y = x^2$ oleh $D[0; 3]$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3x \\ 3y \end{pmatrix}$$

$$\Rightarrow x' = 3x \quad \Rightarrow y' = 3y$$

$$\frac{x'}{3} = x \quad \frac{y'}{3} = y$$

$$\Rightarrow \left(\frac{y'}{3}\right) = \left(\frac{x'}{3}\right)^2$$

$$\frac{y}{3} = \frac{x^2}{9}$$

$$y = \frac{1}{3}x^2$$

$$\therefore y = x^2 \xrightarrow{D[0; 3]} y = \frac{1}{3}x^2$$

d.) $x^2 + y^2 = 4$ oleh R_{270°

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \\ = \begin{pmatrix} -y \\ x \end{pmatrix}$$

$$\Rightarrow x' = -y \quad \Rightarrow y' = x \\ -x' = y$$

$$\Rightarrow (y')^2 + (-x')^2 = 4$$

$$x^2 + y^2 = 4$$

$$\therefore x^2 + y^2 = 4 \xrightarrow{R_{270^\circ}} x^2 + y^2 = 4$$

6. Dik titik $(6, 2)$

$$(6, 2) \xrightarrow{M_{y=\sqrt{3}x}} (x', y')$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 0 & \sqrt{3} \\ \sqrt{3} & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \\ = \begin{pmatrix} 0 & \sqrt{3} \\ \sqrt{3} & 0 \end{pmatrix} \begin{pmatrix} 6 \\ 2 \end{pmatrix} \\ = \begin{pmatrix} 2\sqrt{3} \\ 6\sqrt{3} \end{pmatrix}$$

$$\therefore (6, 2) \xrightarrow{M_{y=\sqrt{3}x}} (2\sqrt{3}, 6\sqrt{3})$$

7. $M = \begin{pmatrix} \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{pmatrix}$

$$M^2 = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$$

$$\therefore A' = A = (0, 0)$$

$$B' = B = (2, 0)$$

$$C' = C = (2, 2)$$

$$D' = D = (0, 2)$$

Bangun yang terbentuk adalah Persegi

8. $\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$

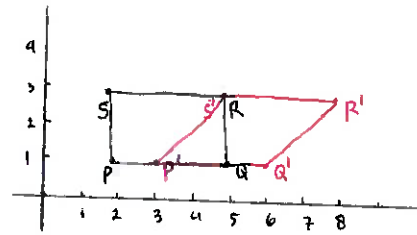
$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} x+y \\ y \end{pmatrix}$$

$$\Rightarrow P(2, 1) \rightarrow P' = (3, 1)$$

$$\Rightarrow Q(5, 1) \rightarrow Q' = (6, 1)$$

$$\Rightarrow R(5, 3) \rightarrow R' = (8, 3)$$

$$\Rightarrow S(2, 3) \rightarrow S' = (5, 3)$$



9. a) $(5, 2) \xrightarrow{T = \begin{pmatrix} -2 \\ 1 \end{pmatrix}} (x', y') \xrightarrow{T = \begin{pmatrix} 5 \\ -4 \end{pmatrix}} (x'', y'')$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 5-2 \\ 2+1 \end{pmatrix} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$$

$$\begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} 3+5 \\ 3-4 \end{pmatrix} = \begin{pmatrix} 8 \\ -1 \end{pmatrix}$$

$$\therefore (5, 2) \xrightarrow{T = \begin{pmatrix} -2 \\ 1 \end{pmatrix}} (3, 3) \xrightarrow{T = \begin{pmatrix} 5 \\ -4 \end{pmatrix}} (8, -1)$$

b) $(4, -2) \xrightarrow{M_{x=3}} (x', y') \xrightarrow{M_{x=7}} (x'', y'')$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 2(3)-4 \\ -2 \end{pmatrix} = \begin{pmatrix} 2 \\ -2 \end{pmatrix}$$

$$\begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} 2(7)-2 \\ -2 \end{pmatrix} = \begin{pmatrix} 12 \\ -2 \end{pmatrix}$$

$$\therefore (4, -2) \xrightarrow{M_{x=3}} (2, -2) \xrightarrow{M_{x=7}} (12, -2)$$

c) $(-6, 2)$, $M_1 y = -2$, $M_2 y = 5$

$$(-6, 2) \xrightarrow{M_2 \circ M_1} (-6, 2(5+2)+2)$$

$$(-6, 2) \xrightarrow{M_2 \circ M_1} (-6, 16)$$

d) $(-7, 1)$, $M_1 (x=4)$, $M_2 (y=3)$

$$(x, y) \xrightarrow{M_2 \circ M_1} (x+2(h-x), y+2(k-y))$$

$$(-7, 1) \xrightarrow{M_2 \circ M_1} (-7+2(4+7), 1+2(3-1))$$

$$(-7, 1) \xrightarrow{M_2 \circ M_1} (15, 5)$$

e) $(4, 3)$, R_{-90° , $D[0; -2]$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = (D[0; -2] \circ R_{-90^\circ}) \begin{pmatrix} x \\ y \end{pmatrix}$$

$$= \begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix} \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 4 \\ 3 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & -2 \\ 2 & 0 \end{pmatrix} \begin{pmatrix} 4 \\ 3 \end{pmatrix}$$

$$= \begin{pmatrix} -6 \\ 8 \end{pmatrix}$$

$\therefore (4, 3) \xrightarrow{D[0; -2] \circ R_{-90^\circ}} (-6, 8)$

f) $\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 1 & 3 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 2 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 7 \\ -2 \end{pmatrix}$

$$= \begin{pmatrix} 5 & 1 \\ -2 & -1 \end{pmatrix} \begin{pmatrix} 7 \\ -2 \end{pmatrix}$$

$$= \begin{pmatrix} 35 - 2 \\ -14 + 2 \end{pmatrix}$$

$$= \begin{pmatrix} 33 \\ -12 \end{pmatrix}$$

$$(7, -2) \xrightarrow{T_2 \circ T_1} (33, -12)$$

10. $O = (0, 0)$ $B = (1, 1)$

$$A = (1, 0) \quad C = (0, 1)$$

a) $T = \begin{pmatrix} 3 & -1 \\ 1 & 3 \end{pmatrix}$

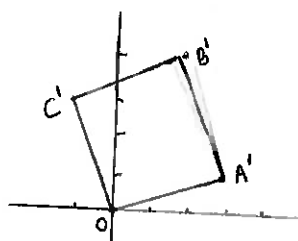
$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 3 & -1 \\ 1 & 3 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 3x - y \\ x + 3y \end{pmatrix}$$

$\Rightarrow O' = (0, 0)$ $B' = (2, 4)$

$A' = (3, 1)$ $C' = (-1, 3)$

b.)



11. $A = (4, -1)$

$B = (3, 7)$

$C = (7, 11)$ } $M = (5, 9)$

a) $M \xrightarrow{D[A; \frac{3}{2}]} P$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \frac{3}{2} & 0 \\ 0 & \frac{3}{2} \end{pmatrix} \begin{pmatrix} x-4 \\ y+1 \end{pmatrix} + \begin{pmatrix} 4 \\ -1 \end{pmatrix}$$

$$= \begin{pmatrix} \frac{3}{2} & 0 \\ 0 & \frac{3}{2} \end{pmatrix} \begin{pmatrix} 1 \\ 10 \end{pmatrix} + \begin{pmatrix} 4 \\ -1 \end{pmatrix}$$

$$= \begin{pmatrix} \frac{3}{2} \\ \frac{30}{2} \end{pmatrix} + \begin{pmatrix} 4 \\ -1 \end{pmatrix}$$

$$= \begin{pmatrix} \frac{11}{2} \\ 14 \end{pmatrix}$$

$\therefore P = (\frac{11}{2}, 14)$

$$b.) \text{ garis } AB \Rightarrow \frac{y+1}{7+1} = \frac{x-4}{3-4}$$

$$\frac{y+1}{8} = \frac{x-4}{-1}$$

$$y+1 = -8x+32$$

$$y = -8x+31$$

$$\therefore m = -8$$

$$\Rightarrow \text{garis melalui } P\left(\frac{11}{2}, 14\right) \parallel AB$$

$$y-14 = m\left(x-\frac{11}{2}\right)$$

$$y-14 = -8\left(x-\frac{11}{2}\right)$$

$$y-14 = -8x+44$$

$$y = -8x+58$$

$$c.) AC : -4x+y = -17$$

$$Q \text{ hipot } AC \text{ dan } (b)$$

$$\Rightarrow -4x+y = -17$$

$$8x+y = 58$$

$$-12x = -75$$

$$x = \frac{75}{12} = \frac{25}{4}$$

$$y = 8$$

$$\therefore Q = \left(\frac{25}{4}, 8\right)$$

$$13) L \equiv (x+4)^2 + (y-5)^2 = 16$$

$$\Rightarrow M \ x=3$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 6-x \\ y \end{pmatrix}$$

$$\Rightarrow T = \begin{pmatrix} -6 \\ -3 \end{pmatrix}$$

$$\begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} 6-x-6 \\ y-3 \end{pmatrix} = \begin{pmatrix} -x \\ y-3 \end{pmatrix}$$

$$\Rightarrow x'' = -x$$

$$-x'' = x$$

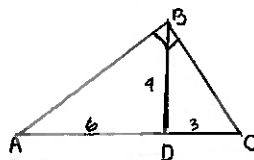
$$\Rightarrow y'' = y-3$$

$$y''+3 = y$$

$$\Rightarrow L \equiv (-x+4)^2 + (y+3-5)^2 = 16$$

$$(-x+4)^2 + (y-2)^2 = 16$$

14)



$$a.) \Delta ABD \text{ bayangan } \Delta BCD$$

$$\Delta BCD \xrightarrow{W \circ V} \Delta ABD$$

$$V = \text{ pencerminan terhadap garis } BD$$

$$W =$$

$$b.) (-1, 2) \xrightarrow{T} (3, 5)$$

$$i) T = \begin{pmatrix} 3-(-1) \\ 5-2 \end{pmatrix} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$$

$$ii) (2, 4) \xrightarrow{T \circ M} (x', y')$$

$$\Rightarrow (2, 4) \xrightarrow{M_y} (-2, 4)$$

$$\Rightarrow (-2, 4) \xrightarrow{T = \begin{pmatrix} 4 \\ 3 \end{pmatrix}} (2, 7)$$

$$\therefore (2, 4) \xrightarrow{T \circ M} (2, 7)$$

$$12) \begin{pmatrix} x_A' & x_B' & x_C' \\ y_A' & y_B' & y_C' \end{pmatrix} = \begin{pmatrix} M_{y=x} \circ R_{90^\circ} \end{pmatrix} \begin{pmatrix} x_A & x_B & x_C \\ y_A & y_B & y_C \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} -4 & 3 & 3 \\ 5 & -6 & 9 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} -4 & 3 & 3 \\ 5 & -6 & 9 \end{pmatrix}$$

$$= \begin{pmatrix} -4 & 3 & 3 \\ -5 & 6 & 9 \end{pmatrix}$$

$$\therefore P = (-4, -5), Q = (3, 6), R = (3, 9)$$

$$(iii) (2,4) \xrightarrow{M \circ T} (x', y')$$

$$\Rightarrow (2,4) \xrightarrow{T = \begin{pmatrix} 4 \\ 3 \end{pmatrix}} (6,7)$$

$$\Rightarrow (6,7) \xrightarrow{M_y} (-6,7)$$

$$\therefore (2,4) \xrightarrow{M \circ T} (-6,7)$$

c.) $T = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$; M : pencerminan sb x

$$(i) (2,4) \xrightarrow{M \circ T} (x', y')$$

$$\Rightarrow (2,4) \xrightarrow{T = \begin{pmatrix} 4 \\ 3 \end{pmatrix}} (6,7)$$

$$\Rightarrow (6,7) \xrightarrow{M_x} (6,-7)$$

$$\therefore (2,4) \xrightarrow{M \circ T} (6,-7)$$

$$(ii) (2,4) \xrightarrow{T \circ M} (x', y')$$

$$\Rightarrow (2,4) \xrightarrow{M_x} (2,-4)$$

$$\Rightarrow (2,-4) \xrightarrow{T = \begin{pmatrix} 4 \\ 3 \end{pmatrix}} (6,-1)$$

$$\therefore (2,4) \xrightarrow{T \circ M} (6,-1)$$

15] Dapat terlihat pada gambar

a.) titik tengah antara titik-titik bersesuaian

Pada ΔD dan ΔE adalah $(2,3)$

(1) Pusat rotasi di $(2,3)$

(ii) Besar sudut rotasi adalah 180°

b.) $P = (2,4)$, tentukan P' oleh translasi $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$

dan pencerminan garis BC ($x=3$)

$$\Rightarrow (2,4) \xrightarrow{T = \begin{pmatrix} 4 \\ 2 \end{pmatrix}} (6,6)$$

$$\Rightarrow (6,6) \xrightarrow{M_{x=3}} (2(3)-6, 6)$$

$$\therefore P' = (0,6)$$

c.) (1) V = pencerminan pada $x=4,5$

W = Dilatasi sebesar 3 kali

$$(ii) \text{ garis AB } \Rightarrow \frac{y-2}{4-2} = \frac{x-2}{3-2}$$

$$\frac{y-2}{2} = x-2$$

$$y = 2x - 4 + 2$$

$$y = 2x - 2$$

$$\Rightarrow (x, y) \xrightarrow{W \circ V} (x'', y'')$$

$$\Rightarrow \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 2(4,5) - x \\ y \end{pmatrix} = \begin{pmatrix} 9-x \\ y \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} x'' \\ y'' \end{pmatrix} = \begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix} \begin{pmatrix} 9-x \\ y \end{pmatrix} = \begin{pmatrix} 27-3x \\ 3y \end{pmatrix}$$

$$\Rightarrow x'' = 27-3x \quad \Rightarrow y'' = 3y$$

$$x = \frac{27-3x''}{3}$$

$$y = \frac{y''}{3}$$

Bayangan $y = 2x - 2$

$$\hookrightarrow \frac{y''}{3} = 2 \left(\frac{27-3x''}{3} \right) - 2$$

$$y'' = 2(27-3x'') - 6$$

$$y'' = 54 - 6x'' - 6$$

$$y'' = 48 - 6x''$$

\therefore Persamaan Bayangan AB adalah $y = 48 - 6x$

Soal Pendalaman Halaman 172

$$(x, y) \xrightarrow{R_{90^\circ}} (x', y') \xrightarrow{M_y} (x'', y'')$$

$$\bullet \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & -\sin 90^\circ \\ \sin 90^\circ & \cos 90^\circ \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\Rightarrow \bullet x' = -y$$

$$\bullet y' = x$$

$$\Rightarrow \bullet x'' = -x' = -(-y) = y \Leftrightarrow y = x''$$

$$\bullet y'' = y' = x \quad \Leftrightarrow x = y''$$

\therefore Bayangan $y = 4x^2 - 8$ oleh $M_y \circ R_{90^\circ}$

$$\equiv x = 4y^2 - 8$$

Jawaban: D.