FORM 5
CHAPTER 5

Self Test 1

1 (a) Not congruent because the corresponding sides are not the same.

(b) Congruent because the length of the corresponding sides and the size of the corresponding angles are the same.

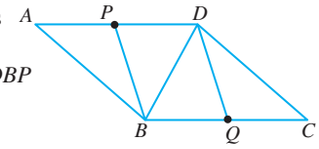
(c) Not congruent because the corresponding interior angles are not the same.

2 (a) $\angle EFG = \angle KLM$, $FG = LM$ (or $\angle FEG = \angle LKM$, $EG = KM$)

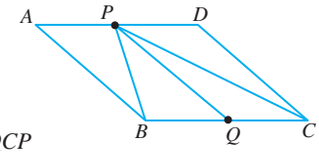
(b) $FG = LM$, $\angle FGE = \angle LMK$ (or $EG = KM$, $\angle EFG = \angle KLM$)

3 (a) Side-Side-Side (b) Side-Side-Angle

4 (a) $PD = QB$
$\angle PDB = \angle QBD$
$DB = BD$
Satisfies the characteristics of Side-Angle-Side (SAS)
Thus, triangles BDQ and DBP are congruent.



(b) $AB = QP$
$\angle PAB \neq \angle CQP$
$AP = QC$
Does not satisfy the characteristics of Side-Angle-Side (SAS).
Thus, triangles APB and QCP are not congruent.



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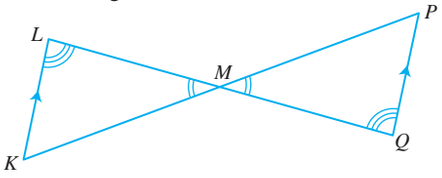
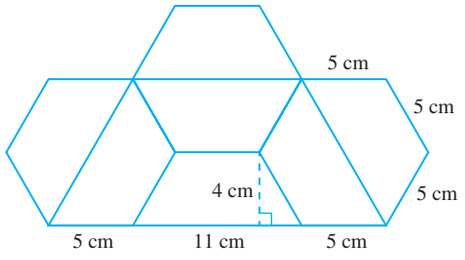


$KM = PM$
$\angle LMK = \angle QMP$
$LM = QM$
Satisfies the characteristics of Side-Angle-Side (SAS). Thus, triangles KLM and PQM are congruent.

6 (a) $7p + 6 = 20$ $\quad$ $4q + 5 = 21$
$7p = 14$ $\quad$ $4q = 16$
$p = 2$ $\quad$ $q = 4$

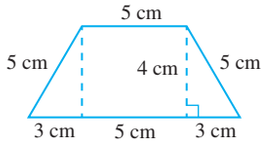
(b) Perimeter $= 20 + 8 + 20 + 21 + 21$
$= 90$ cm

7



Perimeter $= 11 + 11(5)$
$= 11 + 55$
$= 66$ cm

Area $= 7 \times \frac{1}{2} \times (5 + 11) \times 4$
$= 224$ cm^2

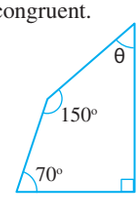


Self Test 2

1 (a) Not similar because the corresponding angles are not the same.

(b) Similar because all the corresponding sides are in proportion and all the corresponding interior angles are congruent.

(c) $\theta = 360° - (90 + 70 + 150)°$
$= 360° - 310°$
$= 50°$
The corresponding angles are congruent.
No further information about the corresponding sides.
Thus, the similarity of the pair of objects is unable to be determined.

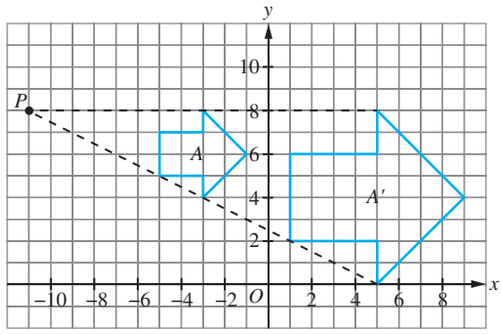


(d) Ratio of the corresponding sides: $\frac{5}{2.5} = 2$
$\frac{10}{5} = 2$
$\frac{6}{3.5} = \frac{12}{7}$

The corresponding sides are not in proportion. Thus, this pair of objects are not similar.

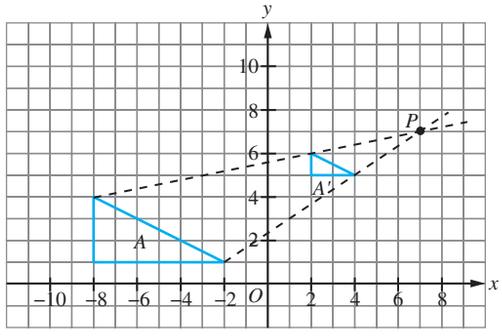
2 A and G, B and E, C and H, D and F

3 (a) $k = \frac{4}{2}$
$= 2$



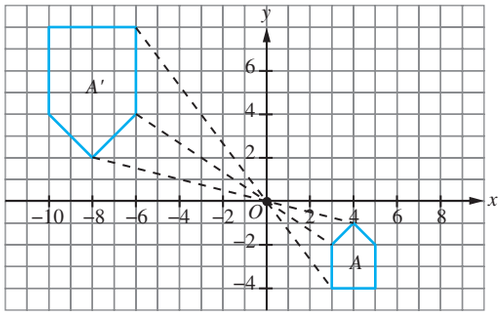
Enlargement with a scale factor, $k = 2$ at the centre $P(-11, 8)$

(b) $k = \frac{1}{3}$



Enlargement with a scale factor, $k = \frac{1}{3}$ at the centre $P(7, 7)$.

(c)



$k = -\frac{4}{2}$

$= -2$

Enlargement with a scale factor, $k = -2$ at the origin $(0, 0)$.

4 (a) $k = \frac{10}{6}$

$= \frac{5}{3}$

Enlargement with a scale factor, $k = \frac{5}{3}$ at the centre P

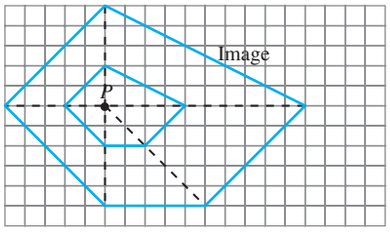
(b) $k = \frac{3}{6}$

$= \frac{1}{2}$

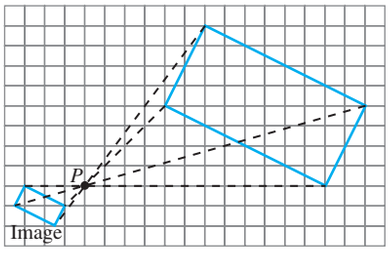
Enlargement with a scale factor, $k = \frac{1}{2}$ at the centre P

5 (a) Object = B, image = A (b) Object = B, image = A

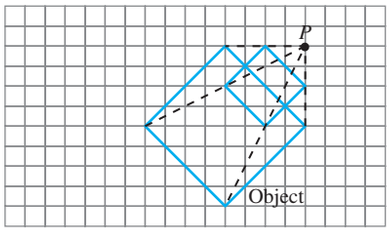
6 (a)



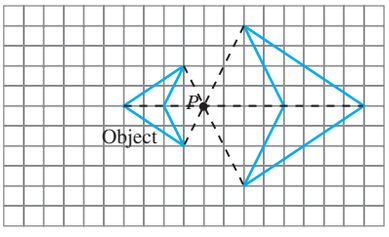
(b)



7 (a)



(b)



8 (a) $k^2 = \frac{\text{Area of image}}{\text{Area of object}}$

$= \frac{180}{20}$

$= 9$

$k = \pm\sqrt{9}$

$x = \pm 3$

(b) $k^2 = \frac{\text{Area of image}}{\text{Area of object}}$

$2^2 = \frac{60}{x}$

$x = \frac{60}{4}$

$= 15 \text{ unit}^2$

(c) $k^2 = \frac{\text{Area of image}}{\text{Area of object}}$

$\left(-\frac{3}{2}\right)^2 = \frac{x}{80}$

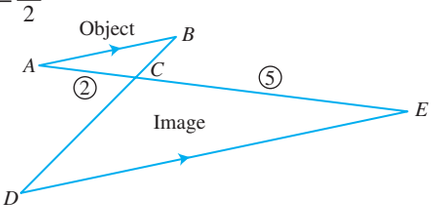
$x = \frac{9}{4} \times 80$

$= 180 \text{ unit}^2$

9 Given $5AC = 2EC$

(a) Scale factor, $k = \frac{\text{image}}{\text{object}}$

$= \frac{5}{2}$



(b) $k^2 = \frac{\text{Area of image}}{\text{Area of object}}$

$\left(\frac{5}{2}\right)^2 = \frac{\text{Area of } \Delta EDC}{25}$

Area of $\Delta EDC = \frac{25}{4} \times 25$

$= 156\frac{1}{4} \text{ cm}^2$

Area of the whole diagram $= \left(25 + 156\frac{1}{4}\right) \text{cm}^2$

$= 181\frac{1}{4} \text{ cm}^2$

10 Let object = $APQRS$, image = $ABCDE$ and the area of object = x

$k^2 = \frac{\text{Area of image}}{\text{Area of object}}$

$\left(\frac{10}{4}\right)^2 = \frac{x + 144.4}{x}$

$6.25x = x + 144.4$

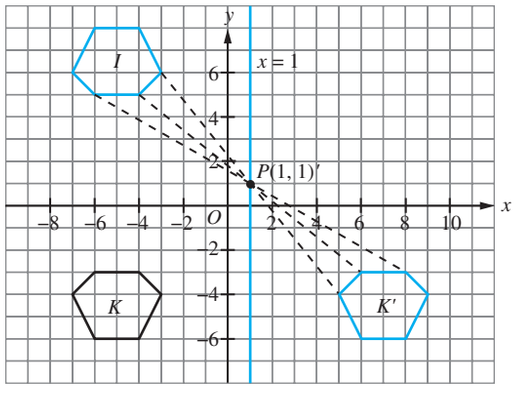
$5.25x = 144.4$

$x = 27.5 \text{ cm}^2$

Self Test 3

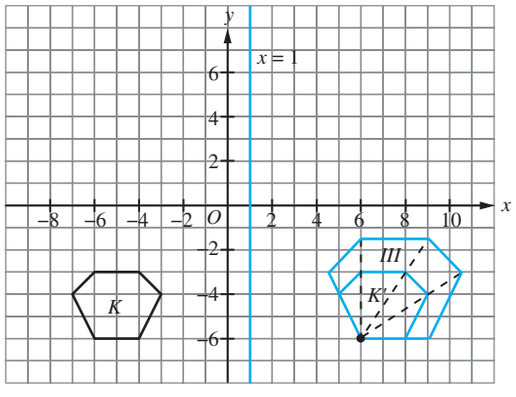
1 (a) Perform transformation **R**, followed by transformation **P**

Image $K = I$



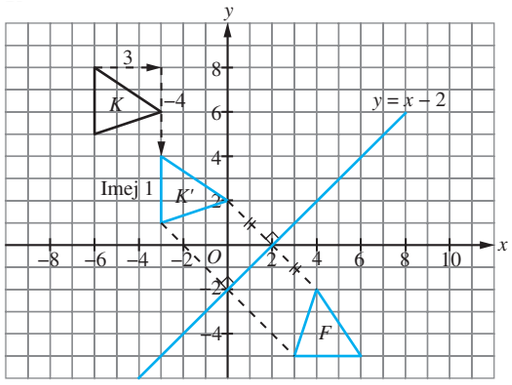
(b) Perform transformation **R**, followed by transformation **Q**

Image $K = III$



2 (a) Object → Image 1 → Image 2 (K)
R **P**

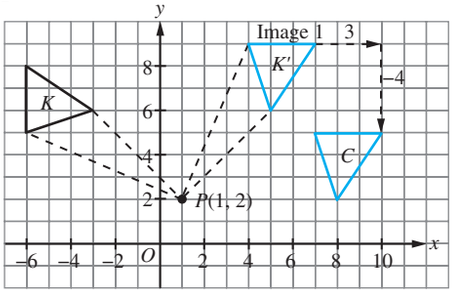
From G, perform the inverse of **P**, followed by the inverse of **R**



∴ The object of K is F.

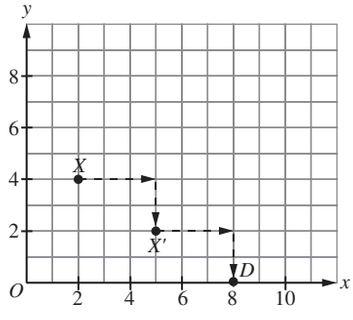
(b) Object → Image 1 → Image 2 (K)
P **Q**

From K, perform the inverse of **Q**, followed by the inverse of **P**



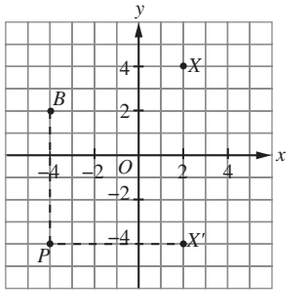
∴ The object of K is C.

3 (a) (i) $X \rightarrow X' \rightarrow X''$
P **P**



The final image of X is D.

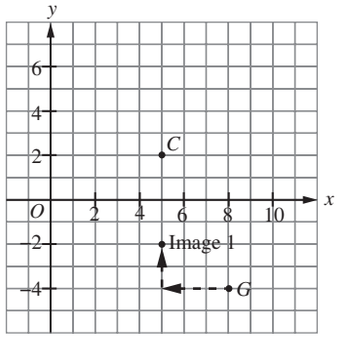
(ii) $X \rightarrow X' \rightarrow X''$
Q **R**



The final image of X is B.

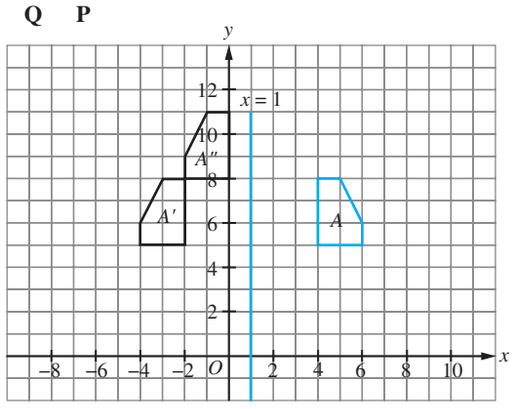
(b) Object → Image 1 → Image 2 (G)
Q **P**

From G, perform the inverse of **P**, followed by the inverse of **Q**

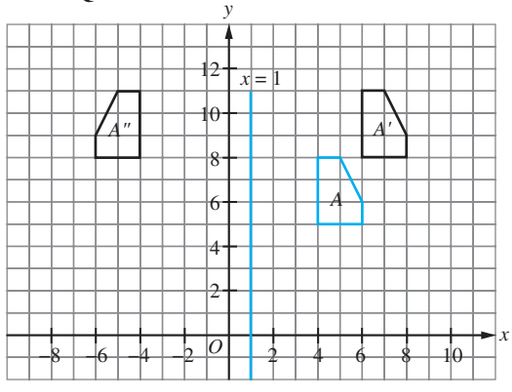


The object of G is C.

4 (a) $A \rightarrow A' \rightarrow A''$
Q **P**

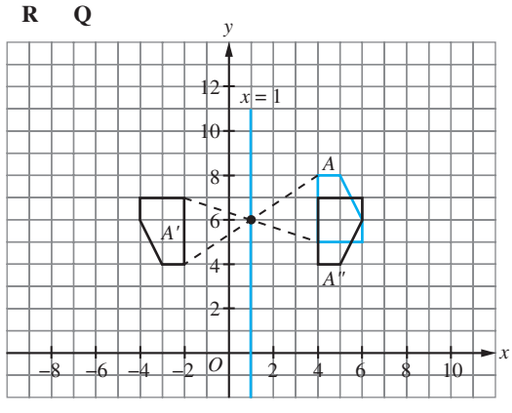


$A \rightarrow A' \rightarrow A''$
P **Q**



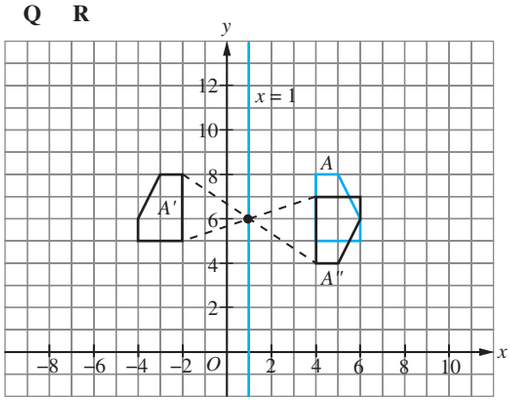
The images under the combined transformations **PQ** and **QP** are different, thus the combined transformation **PQ** does not satisfy the commutative law.

(b) $A \rightarrow A' \rightarrow A''$
R **Q**



$A \to A' \to A''$

Q **R**



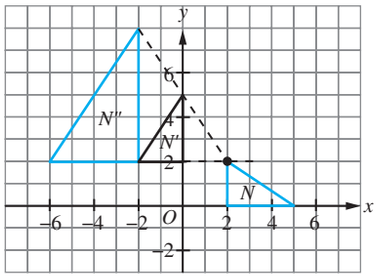
The images under the combined transformations **QR** and **RQ** are the same, thus the combined transformation **QR** satisfies the commutative law.

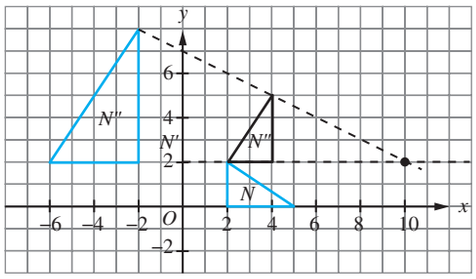
5 $N \to N' \to N''$

W **V**

W = Rotation of 90° anticlockwise at the origin (0, 0)

V = Enlargement with a scale factor, $k = 2$ at the centre (2, 2)





or

W = Rotation of 90° anticlockwise at the centre (2, 2)

V = Enlargement with a scale factor, $k = 2$ at the centre (10, 2)

6 (a) (i) $J \to$ Image 1 $\to$ Image 2 (K)

W **V**

W = Rotation of 90° anticlockwise at the centre (–3, 10)

V = Translation $\begin{pmatrix} 7 \\ -3 \end{pmatrix}$

(ii) $J \to$ Image 1 $\to$ Image 2 (L)

Y **X**

Y = Enlargement with a scale factor, $k = 2$ at the centre (–7, 10)

X = Reflection on the line $x = 2$

(b) Rotation of 90° anticlockwise at the centre (2, 12)

7 $K \to L \to M$

(a) (i) **Q** = Reflection on the line $x = 1$

(ii) **P** = Enlargement with a scale factor, $k = \frac{3}{2}$ at the centre (8, 1)

(b) Let the area of the shaded region $= m$

$$\frac{\text{Area of image}}{\text{Area of object}} = \left(\frac{3}{2}\right)^2$$

$$\frac{m + 36}{36} = \frac{9}{4}$$

$$m + 36 = \frac{9}{4}(36)$$

$$m = 81 - 36$$

$$= 45 \text{ m}^2$$

Self Test 4

1 (a) Not a tessellation (b) Not a tessellation

(c) Tessellation (d) Tessellation

2 (a) Rotation of 180° at the centre P.

(b) Length of symmetrical axis of the equilateral triangle

$= \sqrt{4^2 - 2^2}$

$= \sqrt{12}$

$= 2\sqrt{3}$ cm

Translation $\begin{pmatrix} -8 \\ -8\sqrt{3} \end{pmatrix}$ cm

(c) $D \to E$: Rotation of 180° at the centre R.

$D \to F$: Translation $\begin{pmatrix} 8 \\ 0 \end{pmatrix}$

SPM PRACTICE

Paper 1

1 **C**

2 **C**

3 **B** $\angle PQR = 180° - 127°$

$= 53°$

4 **B** $2x + 4 = 4x - 6$

$2x = 4 + 6$

$x = 5$

Perimeter = 76

$2[2(5) + 4 + 12y] = 76$

$14 + 12y = 38$

$12y = 24$

$y = 2$

5 **D** $\frac{x}{15} = \frac{22.5}{5}$

$x = \frac{22.5}{5} \times 15$

$= 67.5$ cm

6 **A**

7 **B** $W(0, y)$ and $VW = 5$

$\sqrt{(0-4)^2 + (y-6)^2} = 5$

$16 + (y-6)^2 = 25$

$(y-6)^2 = 9$

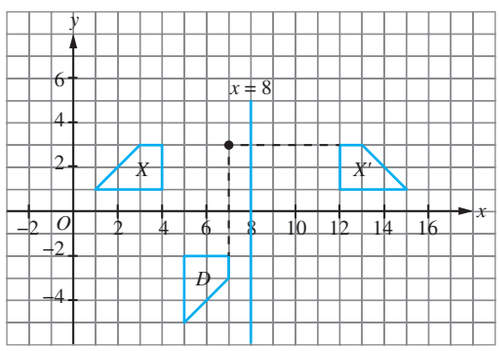
$y - 6 = \pm 3$

$y = 3$ (9 is rejected because W is lower than V)

The translation is $\begin{pmatrix} -4 \\ -3 \end{pmatrix}$

8 **B**

9 **D**



10 **D** Object $\to$ Image 1 $\to$ Image 2 (G)

Q **P**

From G, perform the inverse of **P**, followed by the inverse of **Q**

Paper 2

Section A

1 (a) Transformation **P** = Reflection on the line AD

(b) Transformation **Q** = Rotation of 120° anticlockwise at the centre E.

2 Scale factor, $k = -\frac{10}{4}$

$= -2.5$

(a) **P** = Enlargement with a scale factor, $k = -2.5$ at the centre C

(b) $\frac{\text{Area of image}}{\text{Area of object}} = (2.5)^2$

$\frac{\text{Area of } \Delta EDC}{3.2} = 6.25$

Area of $\Delta EDC = 20 \text{ cm}^2$

Section B

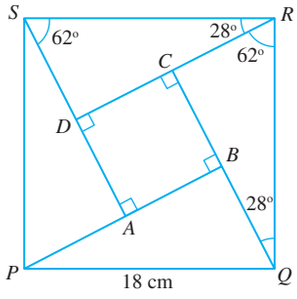
3 (a) $\angle QCR = \angle RDS = 90°$

$\left.\begin{aligned} \angle CQR &= 180° - 90° - 62° \\ &= 28° \\ \angle DRS &= 90° - 62° \\ &= 28° \end{aligned}\right\} \angle CQR = \angle DRS = 28°$

$\left.\begin{aligned} \angle RSD &= 180° - 90° - 28° \\ &= 62° \end{aligned}\right\} \angle QRC = \angle RSD = 62°$

$QR = RS = 18$ cm

Triangles RCQ and SDR satisfy the characteristics of Angle-Side-Angle (ASA), thus both triangles are congruent.



(b) $RCQ \xrightarrow[\mathbf{Y}]{} \text{image 1} \xrightarrow[\mathbf{X}]{} \text{image 2 } (SDR)$

Y = Rotation of 90° anticlockwise at the centre R

X = Translation $\begin{pmatrix} -18 \\ 0 \end{pmatrix}$

(c) Area of quadrilateral $ABCD = 18(18) - 4(67.15) \text{ cm}^2$

$= 324 - 268.6$

$= 55.4$

$AB^2 = 55.4$

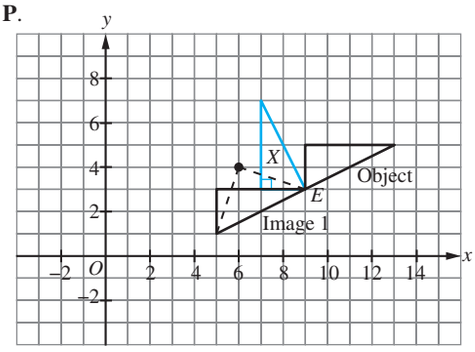
$AB = 7.44$ cm

4 (a) (i) $E(9, 3) \xrightarrow[\mathbf{P}]{} E'(5, 1) \xrightarrow[\mathbf{P}]{} E''(1, -1)$

(ii) $E(9, 3) \xrightarrow[\mathbf{P}]{} E'(5, 1) \xrightarrow[\mathbf{Q}]{} E''(9, 3)$

(b) (i) Object $\xrightarrow[\mathbf{P}]{}$ Image 1 $\xrightarrow[\mathbf{Q}]{}$ Image 2 (X)

From X, perform the inverse of **Q**, followed by the inverse of **P**.



(ii) Rotation of 90° clockwise at the centre $E(9, 3)$.

Section C

5 Scale 1 cm : 1 500 cm

1 cm : 15 m

(a) (i) Perimeter $= (10 + 5 + 10 + 5 + 5) \times 15$ m

$= 525$ m

(ii) Total cost = 525 m × RM15 per metre

= RM7 875

(b) (i) **P** = Enlargement with a scale factor, $k = \frac{2}{5}$ at the centre $(6, 3)$

Q = Reflection on the line $x = 7$

(ii) $\frac{\text{Area of image}}{\text{Area of object}} = \left(\frac{2}{5}\right)^2$

$\frac{X}{3\,712.5 + X} = \frac{4}{25}$

$25X = 4(3\,712.50) + 4X$

$21X = 14\,850$

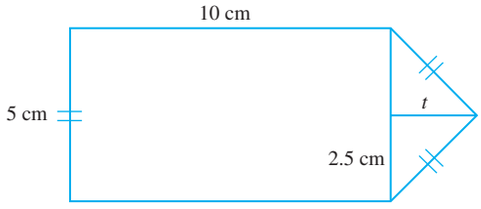
$X = 707\frac{1}{7} \text{ m}^2$

Total area of X and $Y = 2 \times 707\frac{1}{7} \text{ m}^2$

$= 1\,414\frac{2}{7} \text{ m}^2$

(iii) Area of cleared region $= 3\,712.5 + 1\,414\frac{2}{7}$

$= 5\,126\frac{11}{14} \text{ m}^2$



$t = \sqrt{5^2 - 2.5^2}$

$= \sqrt{18.75}$

$= 4.33$ cm

Area of land = Area of rectangle + Area of equilateral triangle

$= (5 \times 15) \times (10 \times 15) + \frac{1}{2}(5 \times 15) \times (4.33 \times 15)$

$= 11\,250 + 2\,435\frac{5}{8}$

$= 13\,685\frac{5}{8} \text{ m}^2$

Area of land that has not been opened

$= 13\,685\frac{5}{8} - 5\,126\frac{11}{14} \text{ m}^2$

$= 8\,558\frac{47}{56} \text{ m}^2$

Area of cleared land : Area that has not been opened

$5\,126\frac{11}{14} : 8\,558\frac{47}{56}$

$6\,380 : 10\,651$