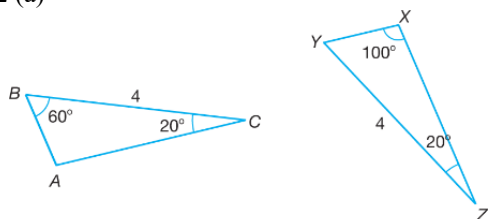


Form 5 Chapter 5
Congruency, Enlargement and Combined Transformation
Fully-Worked Solutions

UPSKILL 5.1

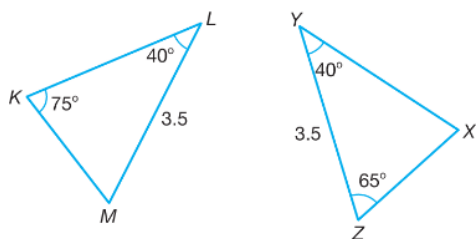
- 1 (a) Congruent
 (b) Congruent
 (c) Not congruent

2 (a)



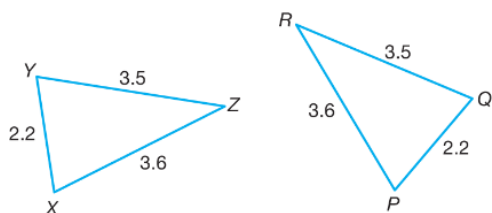
$$\angle XYZ = 180^\circ - 100^\circ - 20^\circ = 60^\circ$$

$$\triangle ABC \cong \triangle YZX \text{ [Angle-Side-Angle]}$$



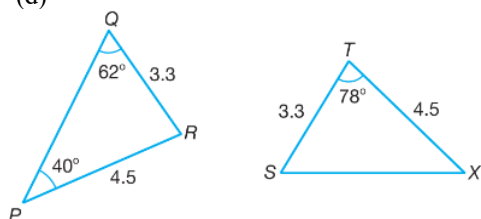
$$\angle YXZ = 180^\circ - 40^\circ - 65^\circ = 75^\circ$$

$$\triangle KLM \cong \triangle XYZ \text{ [Angle-Angle-Side]}$$



$$\triangle XYZ \cong \triangle PQR \text{ [Side-Side-Side]}$$

(d)

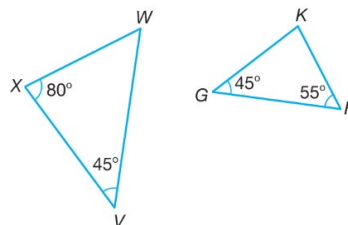


$$\angle PRQ = 180^\circ - 40^\circ - 62^\circ = 78^\circ$$

$$\triangle PRQ \cong \triangle XTS \text{ [Side-Angle-Side]}$$

UPSKILL 5.2

1 (a)

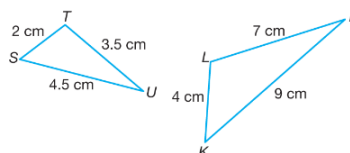


$$\angle XWV = 180^\circ - 80^\circ - 45^\circ = 55^\circ$$

$$\angle GKH = 180^\circ - 45^\circ - 55^\circ = 80^\circ$$

$\triangle XWV$ dan $\triangle KGH$ are similar because corresponding angles are equal.

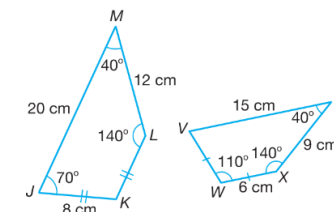
(b)



$$\frac{US}{MK} = \frac{UT}{ML} = \frac{ST}{KL} = \frac{1}{2}$$

$\triangle TUS$ and $\triangle MKL$ are similar because the corresponding sides are proportional.

(c)

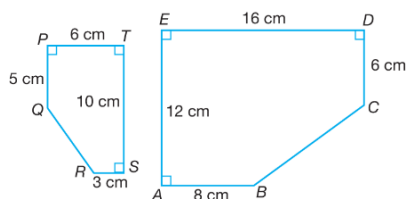


$$\angle JKL = 360^\circ - 140^\circ - 40^\circ - 70^\circ = 110^\circ$$

$$\angle YVW = 360^\circ - 110^\circ - 140^\circ - 40^\circ = 70^\circ$$

$$\frac{JK}{VW} = \frac{LK}{XW} = \frac{ML}{YZ} = \frac{MJ}{YV} = \frac{4}{3}$$

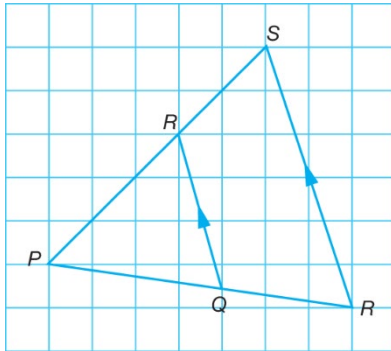
$\triangle LMJK$ and $\triangle XYVM$ are similar because the corresponding angles are equal and the corresponding sides are proportional.



Not similar because $\frac{PQ}{AB} = \frac{ST}{DE} = \frac{5}{8}$ but

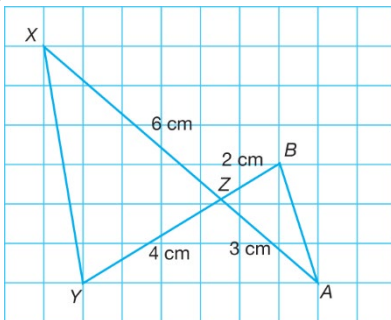
$$\frac{RS}{CD} = \frac{PT}{AE} = \frac{1}{2}$$

2 (a)



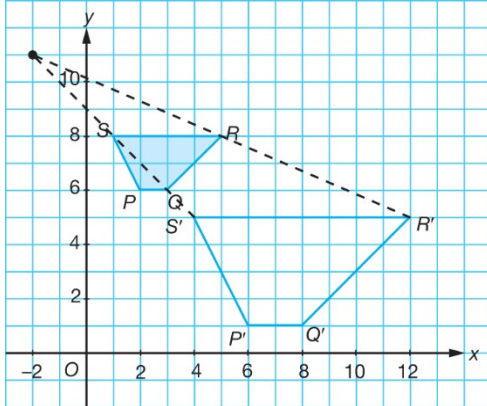
ΔPQR and ΔPRS are similar because the corresponding angles are equal.

(b)



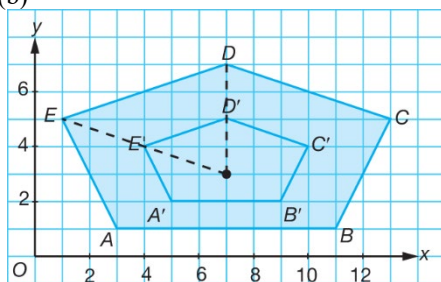
ΔZXY and ΔZAB are similar because they have two corresponding sides which are proportional and one equal angle.

3 (a)



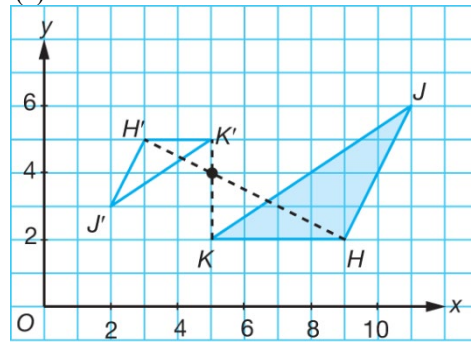
Scale factor = 2

(b)



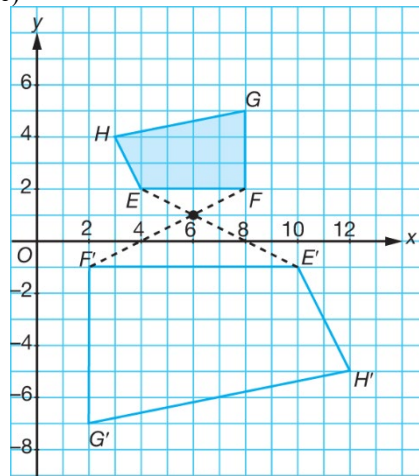
Scale factor = $\frac{1}{2}$

(c)



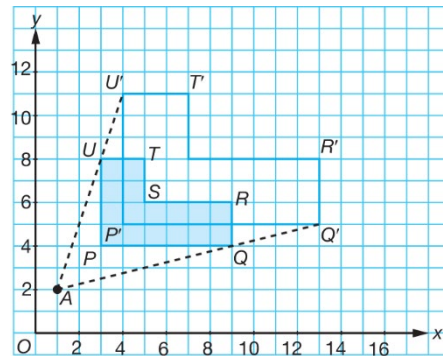
Scale factor = $-\frac{1}{2}$

(c)

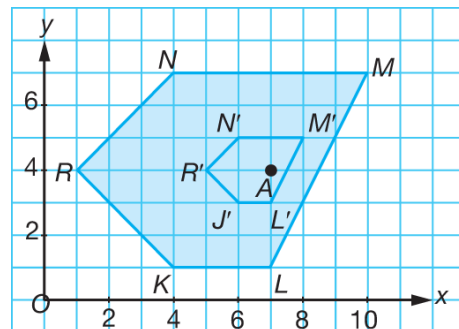


Scale factor = -2

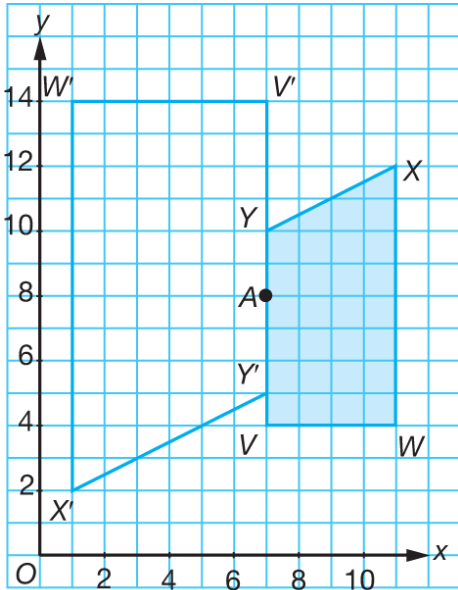
4



5



6



$$10 \text{ Area of } ACDE = \left(\frac{120}{30}\right)^2 \times \text{Area of } ABGF$$

$$\text{Area of } ABGF + \text{Area of the shaded region} = 16 \times \text{Area of } ABGF$$

$$15 \times \text{Area of } ABGF = 225$$

$$\text{Area of } ABGF = 15 \text{ cm}^2$$

$$11 \text{ Area of } HKMN = \left(\frac{30}{20}\right)^2 \times \text{Area of } PQRS$$

$$\text{Area of } PQRS + \text{Area of the shaded region}$$

$$= \frac{9}{4} \times \text{Area of } PQRS$$

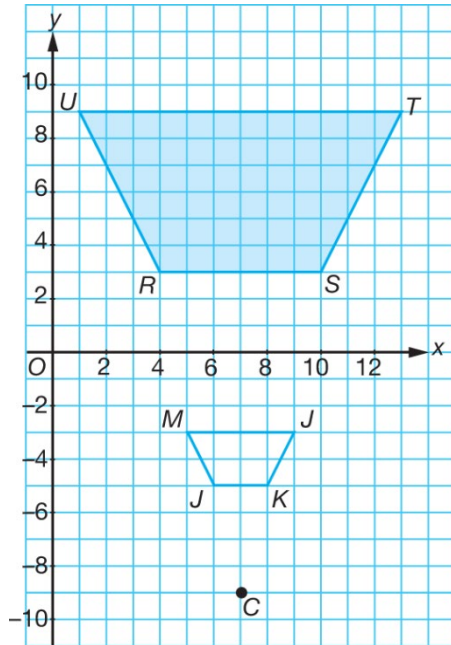
$$\frac{5}{4} \times \text{Area of } PQRS = \text{Area of the shaded region}$$

$$\frac{5}{4} \times \text{Area of } PQRS = 100$$

$$\text{Area of } PQRS = 80 \text{ cm}^2$$

UPS KILL 5.3

7



(b) Area of the shaded region

$$= \frac{22}{7}(21)^2 - \frac{22}{7}(7)^2$$

$$= 1\,386 - 154$$

$$= 1\,232 \text{ cm}^2$$

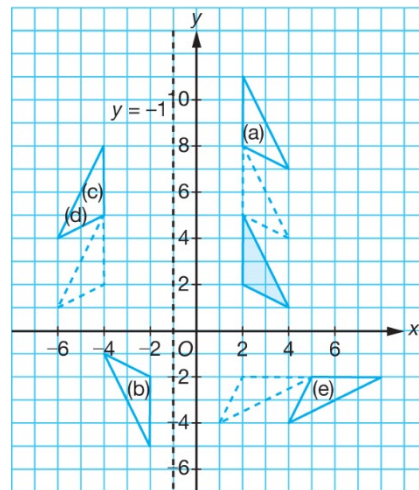
9 (a) Scale factor = $\frac{34}{6\,800} = \frac{1}{200}$

(b) Length of the plan = $\frac{1}{200} \times 10\,500$

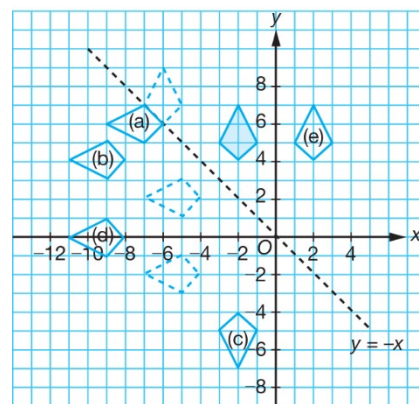
$$= 52.5 \text{ cm}$$

(c) Area of the plan = $34 \times 52.5 = 1\,785 \text{ cm}^2$

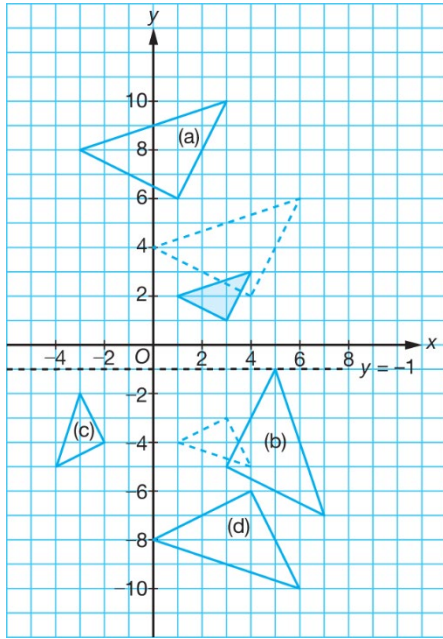
1



2



3

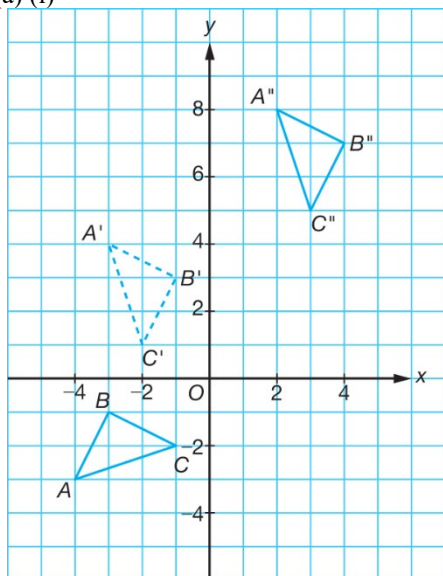


- 4 (a) (i) $A(2, -2) \xrightarrow{T} (-4, 3) \xrightarrow{P} (2, 3)$
 (ii) $A(2, -2) \xrightarrow{P} (-4, -2) \xrightarrow{T} (-10, 3)$
 (b) Not equivalent

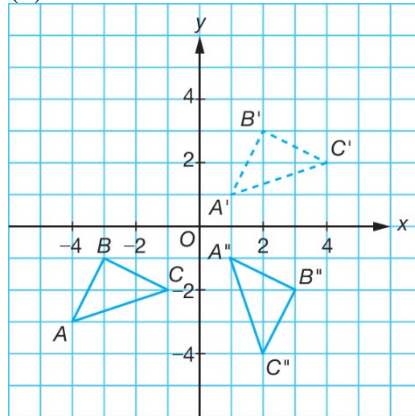
- 5 (a) (i) $B(-3, -4) \xrightarrow{R} (4, -3) \xrightarrow{E} (8, -6)$
 $B(-3, -4) \xrightarrow{E} (-6, -8) \xrightarrow{R} (8, -6)$
 (b) Equivalent

- 6 (a) (i) $C(2, 1) \xrightarrow{P} (2, 5) \xrightarrow{E} (6, 15)$
 (ii) $C(2, 1) \xrightarrow{E} (6, 3) \xrightarrow{P} (6, 3)$
 (b) Not equivalent

7 (a) (i)

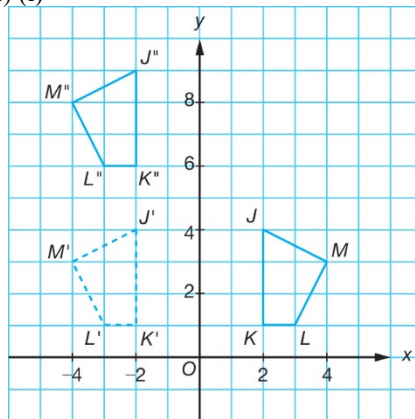


(ii)

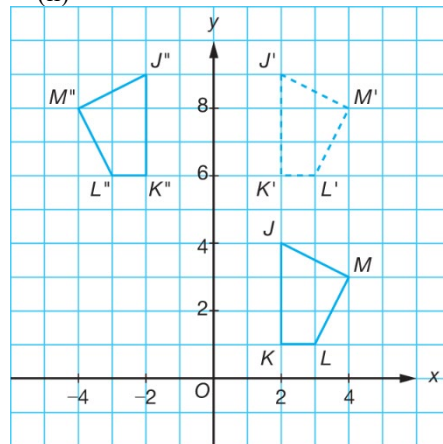


(b) Not equivalent

8 (a) (i)



(ii)



- 9 **V** is reflection in the straight line $y = 3$
U is an enlargement at the centre $A(11, 3)$
 with a scale factor of 3

- 10 **W** is reflection in the straight line $x = 1$

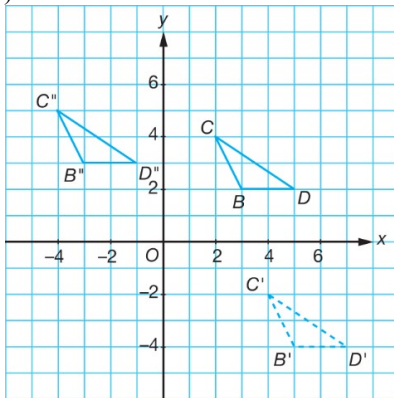
$$\begin{pmatrix} 0 \\ -7 \end{pmatrix}$$

- 11 **K** is a clockwise rotation of 90° about the centre $Q(2, -4)$
H is an enlargement at the centre $Q(2, -4)$ with a scale factor of 2

- 12 **S** is an anticlockwise rotation of 90° about the centre $F(2, 4)$

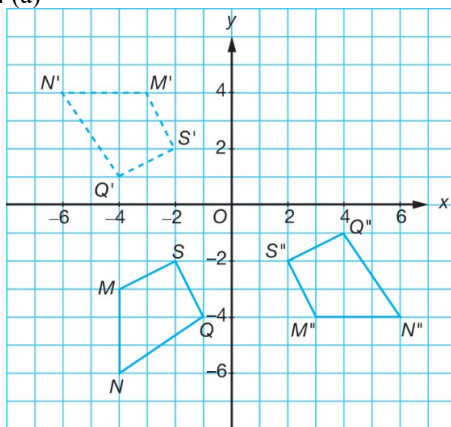
Q is a translation $\begin{pmatrix} -5 \\ 0 \end{pmatrix}$

13 (a)

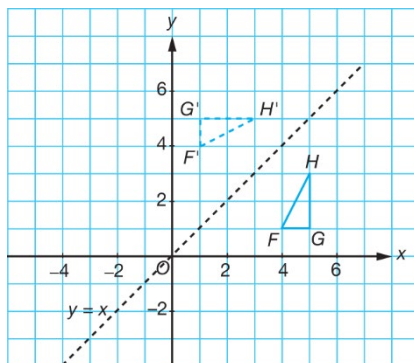


(b) Translation $\begin{pmatrix} -6 \\ 1 \end{pmatrix}$

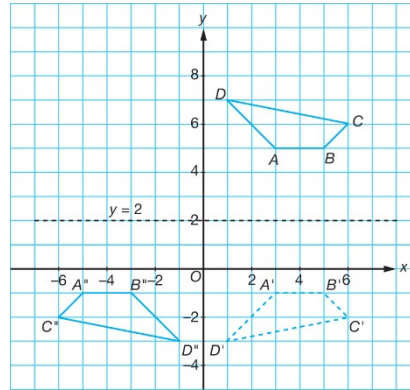
14 (a)



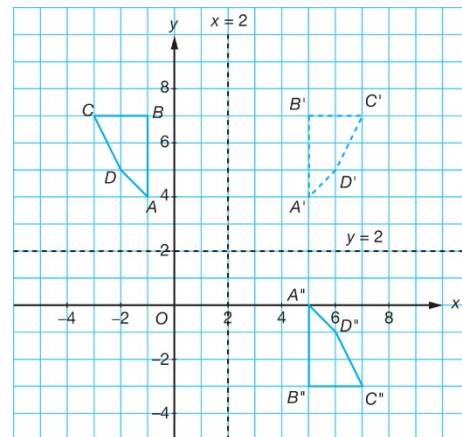
(b) Anticlockwise rotation of 90° about the origin



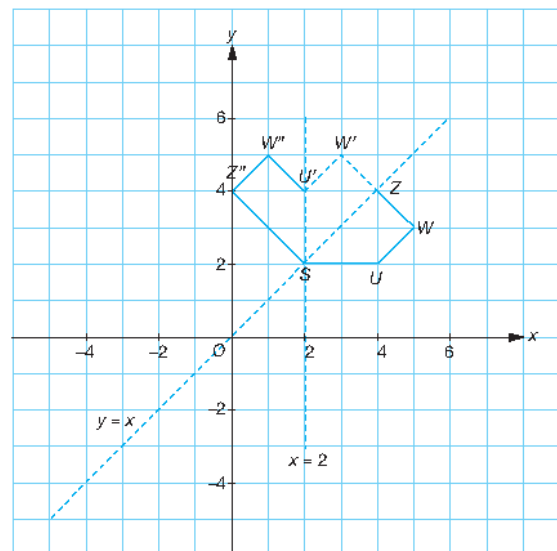
(b) Rotation of 360° about the origin



(b) Rotation of 180° about the centre $(0, 2)$



(b) Rotation of 180° about the centre $(2, 2)$

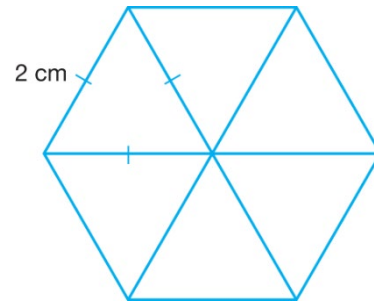


(b) Anticlockwise rotation of 90° about the centre $S(2, 2)$

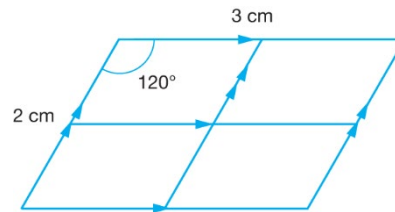
- 19 (a) (i) $B(5, 3) \xrightarrow{P} (3, 5)$
(ii) $B(5, 3) \xrightarrow{P} (3, 5) \xrightarrow{T} (5, 2)$
(iii) $B(5, 3) \xrightarrow{P} (3, 5) \xrightarrow{R} (3, 1)$
- (b) **W** is an anticlockwise rotation of 90° about the centre $C(3, 3)$
V is an enlargement at the centre $M(4, 3)$ with a scale factor of 3
- (c) Area of $\triangle MQN = 3^2 \times \text{Area of } \triangle ABC$
 $288 = 9 \times \text{Area of } \triangle ABC$
Area of $\triangle ABC = 32 \text{ cm}^2$
- 20 (a) (i) Reflection in the x -axis
(ii) Reflection in the y -axis
(iii) Rotation of 180° about the origin
- (b) Enlargement at the centre $(3, 0)$ with a scale factor of 3
- (c) Area of $\triangle KLM = 3^2 \times \text{Area of } \triangle A''B''C''$
 $270 = 9 \times \text{Area of } \triangle A''B''C''$
Area of $\triangle A''B''C'' = 30 \text{ cm}^2$

UPSKILL 5.4

1



2



Summative Practice 5

Multiple-Choice Question

- 1 Area of $SKZWV = 4^2 \times$ Area of $SLMNU$
 Area of $SLMNU +$ Area of the shaded region
 $= 16 \times$ Area of $SLMNU$
 $180 = 15 \times$ Area of $SLMNU$
 Area of $SLMNU = 12 \text{ cm}^2$
 Answer: B
- 2 Translation $\begin{pmatrix} a+h \\ b+k \end{pmatrix}$
 Answer: C
- 3 Clockwise rotation of $\theta - \alpha$ about the origin
 Answer: A
- 4 $(2, 2) \xrightarrow{\mathbf{R}} (2, -2) \xrightarrow{\mathbf{T}} (1, -4)$
 Answer: B
- 5 $(2, 3) \xrightarrow{\mathbf{T}} (3, 1) \xrightarrow{\mathbf{E}} (5, 1)$
 Answer: D

Structured Question

- 1 (a) $\angle PSQ = \angle RQS$ (Alternate angles,
 $PS \parallel QR$)
 $\angle PQS = \angle RSQ$ (Alternate angles,
 $PQ \parallel SR$)
 $SQ (\Delta PSQ) = SQ (\Delta RSQ)$ (Common side)
 $\therefore \Delta PQS \cong \Delta RQS$ (ASA) [Angle-Side-Angle]
- (b) $AC = EC$
 $\angle ACB = \angle ECD$ (Vertically opposite angles)
 $BC = DC$
 $\therefore \Delta ABC \cong \Delta EDC$ (SAS) [Side-Angle-Side]

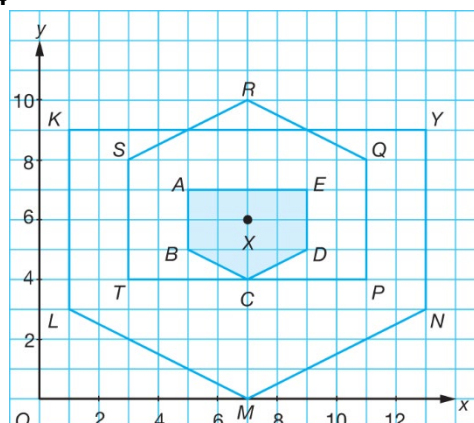
- 2 (a) ΔCED and ΔCHK are similar.

(b) $\frac{HK}{ED} = \frac{9}{5}$
 $\frac{CK}{CD} = \frac{CK}{6}$
 $\therefore \frac{CK}{6} = \frac{9}{5}$
 $CK = 10\frac{4}{5} \text{ cm}$

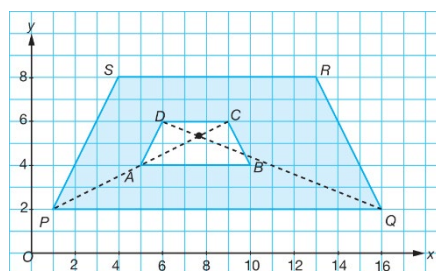
- 3 (a) ΔRST and ΔRUV are similar.

(b) $\frac{UV}{ST} = \frac{x}{2}$
 $\frac{RU}{RS} = \frac{7}{3}$
 $\therefore \frac{x}{2} = \frac{7}{3}$
 $x = 4\frac{2}{3} \text{ cm}$
 $\frac{RT}{RV} = \frac{y}{y+6}$
 $\frac{RS}{RU} = \frac{3}{7}$
 $\therefore \frac{y}{y+6} = \frac{3}{7}$
 $7y = 3y + 18$
 $4y = 18$
 $y = 4\frac{1}{2} \text{ cm}$

4



5



- (a) Centre of enlargement is $(7, 5)$.
- (b) Scale factor $= \frac{SR}{DC} = \frac{9}{3} = 3$
- (c) Area of $PQRS = 3^2 \times$ Area of $ABCD$
 Area of $ABCD +$ Area of the shaded region $= 9 \times$ Area of $ABCD$
 $8 \times$ Area of $ABCD =$ Area of the shaded region
 $8 \times$ Area of $ABCD = 64$
 Area of $ABCD = 8 \text{ cm}^2$

6 (a) $T(10, 2) \xrightarrow{L} (7, 4) \xrightarrow{L} (4, 6)$
 $R(7, 2) \xrightarrow{W} (6, 5) \xrightarrow{L} (3, 7)$
 (b) (i) **U** is a reflection in the straight line $y = 8$.
V is an enlargement at the centre $P(4, 11)$ with a scale factor of 3.
 (c) Area of $RQPST = 3^2 \times \text{Area of } ABCDEF$
 $= 9 \times 60$
 $= 540 \text{ cm}^2$
 Area of the shaded region
 $= 540 - 60 = 480 \text{ cm}^2$

7 (a) (i) $B(2, 4) \xrightarrow{T} (5, 2) \xrightarrow{R} (2, -1)$
 (ii) $B(2, 4) \xrightarrow{R} (0, 2) \xrightarrow{T} (3, 0)$
 (b) (i) (a) **U** is an anticlockwise rotation of 90° about the centre $C(6, 10)$.
 (b) **V** is an enlargement at the centre $(10, 10)$ with a scale factor of 2.
 (ii) Area of $DEGF = 2^2 \times \text{Area of } DABG$
 $= 4 \times 20$
 $= 80$
 Area of the shaded region
 $= 80 - 20$
 $= 60 \text{ m}^2$

8 (a) (i) $(3, 4) \xrightarrow{T} (1, 1)$
 (ii) $(3, 4) \xrightarrow{R} (4, -1)$
 (iii) $(3, 4) \xrightarrow{R} (4, -1) \xrightarrow{T} (2, -4)$
 (b) (i) (a) **V** is a reflection in the straight line $y = 1$
 (b) **W** is an enlargement at the centre $(4, -2)$ with a scale factor of 3
 (ii) Area of $PQRS = 3^2 \times 25 = 225$
 Area of the shaded region
 $= 225 - 25$
 $= 200 \text{ cm}^2$

9 (a) (i) $A(1, 2) \xrightarrow{P} (2, 1) \xrightarrow{T} (-3, 4)$
 (ii) $A(1, 2) \xrightarrow{R} (-3, 0) \xrightarrow{P} (0, -3)$
 (b) (i) (a) **W** is a reflection in the straight line $y = 3$
 (b) **V** is an enlargement at the centre $(2, 1)$ with a scale factor of 3
 (ii) Area of $DHFG = 3^2 \times \text{Area of } MNKL$
 Area of $DHFG = 9 \times 14 = 126$
 Area of the shaded region
 $= 126 - 14$
 $= 112 \text{ units}^2$

10 (a) (i) $J(1, 2) \xrightarrow{R} (5, 2) \xrightarrow{U} (3, 4)$
 (ii) $J(1, 2) \xrightarrow{T} (3, 5) \xrightarrow{R} (3, 5)$
 (b) (i) **N** is a reflection in the straight line $y = 6$
 (ii) **M** is an enlargement at the centre $F(7, 8)$ with a scale factor of 3
 (c) Area of $EFGH = 3^2 \times \text{Area of } ABCD$
 Area of $EFGH = 9 \times 20 = 180 \text{ m}^2$
 Area of the shaded region
 $= 180 - 20$
 $= 160 \text{ m}^2$

11 (a) (i) $A(5, 3) \xrightarrow{T} (3, 7) \xrightarrow{T} (1, 11)$
 (ii) $A(5, 3) \xrightarrow{T} (-3, 5) \xrightarrow{T} (-5, 9)$
 (b) (i) (a) **N** is a reflection in the straight line BC
 (b) **M** is an enlargement at the centre $(4, 2)$ with a scale factor of 3
 (ii) Area of shaded region
 $= \text{Area of } \triangle FDE - \text{Area of } \triangle CGB$
 $= 270 - 30$
 $= 240 \text{ m}^2$

12 (a) (i) $K(5, 9) \xrightarrow{T} (2, 5) \xrightarrow{T} (-1, 1)$
 (ii) $K(5, 9) \xrightarrow{P} (5, 3) \xrightarrow{T} (2, -1)$
 (b) (i) (a) **N** is a clockwise rotation of 90° about the centre $(4, 5)$.
 (b) **M** is an enlargement at the centre $Q(5, 8)$ with a scale factor of 3
 (ii) Area of $QRSTU = 3^2 \times \text{Area of } KLMNP$
 $180 = 9 \times \text{Area of } KLMNP$
 Area of $KLMNP = 20 \text{ m}^2$

13 (a) (i) $H''(4, 4) \xrightarrow{R^{-1}} H'(4, -4) \xrightarrow{T^{-1}} H(-2, 1)$
 (ii) $H''(4, 4) \xrightarrow{E^{-1}} H'(2, 2) \xrightarrow{P^{-1}} H(2, -2)$
 (b) (i) (a) $y = x$ (b) $x = 7$
 (ii) Anticlockwise rotation of 90° about the centre $(7, 7)$
 (c) (i) **W** is an enlargement at the centre $(-2, 0)$ with a scale factor of 2
 (ii) Area of hexagon $A = 56.5 \text{ cm}^2$
 Area of hexagon $P = 2^2 \times 56.5$
 $= 226 \text{ cm}^2$