

Name _____

Date _____

14.5 Rotation — worksheet

Rotate shapes 90° and 180° about a centre of rotation, identify a rotation together with its centre and angle, and recognise that the image is congruent to the object. · 64 questions · Show your working.

Remember

- A **rotation** turns a shape about a **centre of rotation**.
- To describe one fully you need **three** things: the angle, the direction and the centre.
- About the origin, **90° anticlockwise**: $(x, y) \rightarrow (-y, x)$.
- About the origin, **180°** : $(x, y) \rightarrow (-x, -y)$.
- About the origin, **90° clockwise**: $(x, y) \rightarrow (y, -x)$.
- For 180° the direction makes no difference.
- The **centre does not move**. Everything else does.
- About any other centre, work with the offset from the centre, turn that, then add the centre back on.
- The image is **congruent**, and unlike a reflection the vertices still run the same way round.

A · Fluency — Quarter and half turns about the origin.

- 1 Rotate the point (3, 1) **90° anticlockwise** about the origin.

- 2 Rotate the point (2, 4) **90° anticlockwise** about the origin.

- 3 Rotate the point (-1, 3) **90° anticlockwise** about the origin.

- 4 Rotate the point (-4, 2) **90° anticlockwise** about the origin.

- 5 Rotate the point (5, -2) **90° anticlockwise** about the origin.

- 6 Rotate the point (-3, -5) **90° anticlockwise** about the origin.

- 7 Rotate the point (1, -6) **90° anticlockwise** about the origin.

- 8 Rotate the point (4, 4) **90° anticlockwise** about the origin.

- 9 Rotate the point (-2, -1) **90° anticlockwise** about the origin.

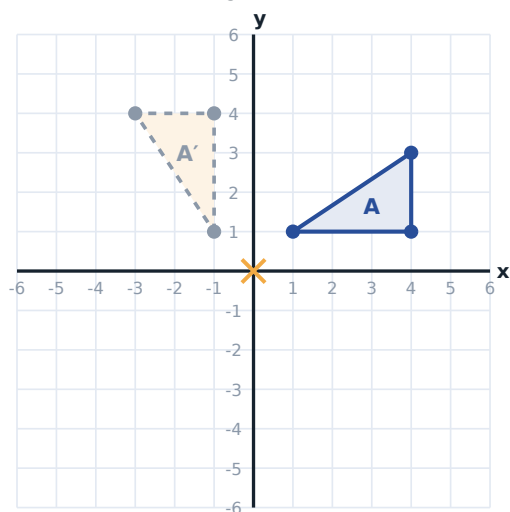
- 10 Rotate the point (6, 3) **90° anticlockwise** about the origin.

- 11 Rotate the point (-5, 1) **90° anticlockwise** about the origin.

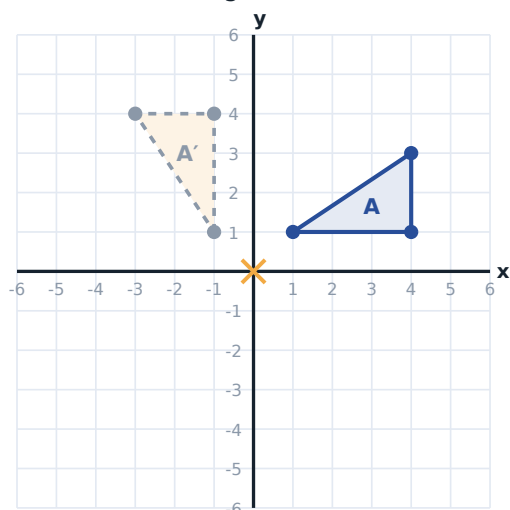
- 12 Rotate the point (2, -3) **90° anticlockwise** about the origin.

- 13** Rotate the point (3, 1) by **180°** about the origin.
-
- 14** Rotate the point (2, 4) by **180°** about the origin.
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- 15** Rotate the point (−1, 3) by **180°** about the origin.
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- 16** Rotate the point (−4, 2) by **180°** about the origin.
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- 17** Rotate the point (5, −2) by **180°** about the origin.
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- 18** Rotate the point (−3, −5) by **180°** about the origin.
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- 19** Rotate the point (1, −6) by **180°** about the origin.
-
- 20** Rotate the point (4, 4) by **180°** about the origin.
-
- 21** Rotate the point (−2, −1) by **180°** about the origin.
-
- 22** Rotate the point (6, 3) by **180°** about the origin.
-
- 23** Rotate the point (−5, 1) by **180°** about the origin.
-
- 24** Rotate the point (2, −3) by **180°** about the origin.
-
- 25** Rotate the point (3, 1) **90° clockwise** about the origin.
-
- 26** Rotate the point (2, 4) **90° clockwise** about the origin.
-
- 27** Rotate the point (−1, 3) **90° clockwise** about the origin.
-
- 28** Rotate the point (−4, 2) **90° clockwise** about the origin.
-
- 29** Rotate the point (5, −2) **90° clockwise** about the origin.
-
- 30** Rotate the point (−3, −5) **90° clockwise** about the origin.
-
- 31** Rotate the point (1, −6) **90° clockwise** about the origin.
-
- 32** Rotate the point (4, 4) **90° clockwise** about the origin.
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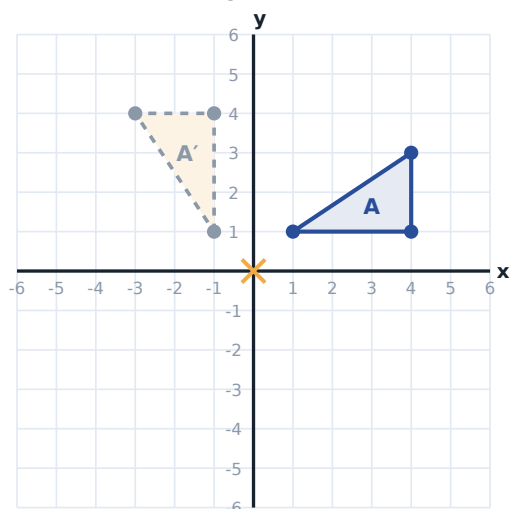
- 33** Triangle A has vertices (1, 1), (4, 1) and (4, 3). It is rotated 90° anticlockwise about the origin. Where does (1, 1) go?



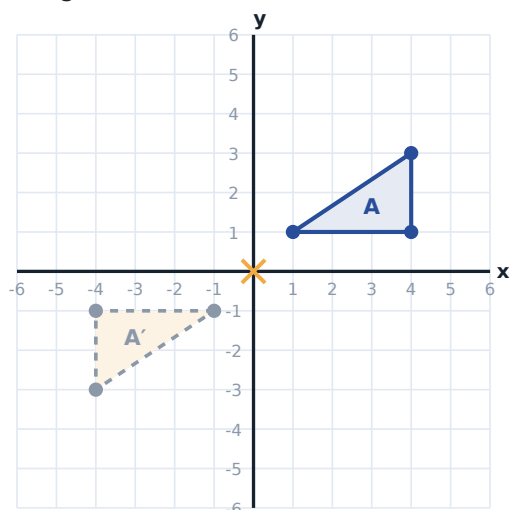
- 34** Triangle A has vertices (1, 1), (4, 1) and (4, 3). It is rotated 90° anticlockwise about the origin. Where does (4, 1) go?



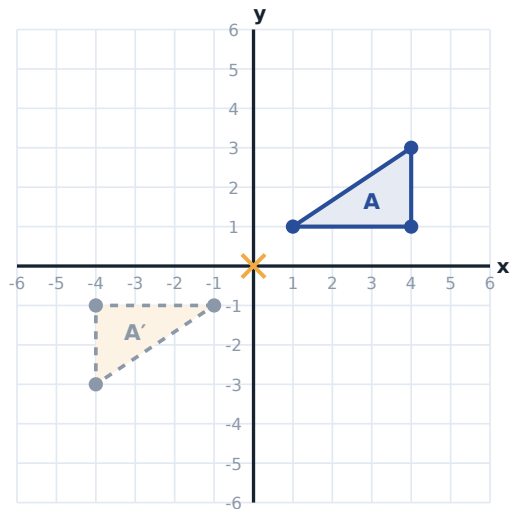
- 35** Triangle A has vertices (1, 1), (4, 1) and (4, 3). It is rotated 90° anticlockwise about the origin. Where does (4, 3) go?



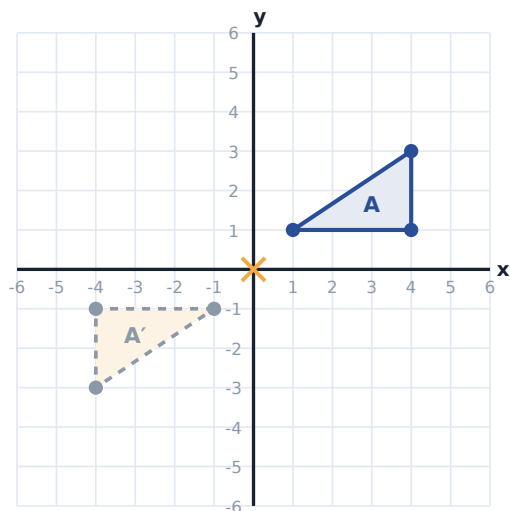
- 36** Triangle A has vertices (1, 1), (4, 1) and (4, 3). It is rotated 180° about the origin. Where does (1, 1) go?



- 37** Triangle A has vertices (1, 1), (4, 1) and (4, 3). It is rotated 180° about the origin. Where does (4, 1) go?



- 38** Triangle A has vertices (1, 1), (4, 1) and (4, 3). It is rotated 180° about the origin. Where does (4, 3) go?



B · Reasoning — What a rotation needs, and what it preserves.

- 39** What does a rotation need before it can be carried out?

- ☐ A mirror line
- ☐ A centre, an angle and a direction
- ☐ A vector
- ☐ A scale factor

- 40** After a rotation, the image is ...

- ☐ larger
- ☐ congruent to the object
- ☐ smaller
- ☐ similar but not congruent

- 41** Why does the direction not matter for a rotation of 180° ?
- ☐ It always matters
 - ☐ Half a turn each way ends in the same place
 - ☐ 180° is special
 - ☐ Because the centre is the origin
- 42** A rotation of 90° anticlockwise about the origin sends (x, y) to ...
- ☐ (y, x)
 - ☐ $(-y, x)$
 - ☐ $(y, -x)$
 - ☐ $(-x, -y)$
- 43** A rotation of 180° about the origin sends (x, y) to ...
- ☐ (y, x)
 - ☐ $(-y, x)$
 - ☐ $(-x, -y)$
 - ☐ $(x, -y)$
- 44** Which point does not move during a rotation?
- ☐ The origin
 - ☐ The centre of rotation
 - ☐ Every point moves
 - ☐ The first vertex
- 45** Is 90° clockwise the same as 270° anticlockwise?
- ☐ Yes
 - ☐ No
- 46** Does a rotation turn a shape over?
- ☐ Yes
 - ☐ No
- 47** Four rotations of 90° in the same direction leave a shape ...
- ☐ upside down
 - ☐ exactly where it started
 - ☐ reflected
 - ☐ twice as big
- 48** How would you describe a transformation fully as a rotation?
- ☐ Just say "rotation"
 - ☐ Give the angle, the direction and the centre
 - ☐ Give the angle only
 - ☐ Give the centre only

C · Challenge — Centres away from the origin, and combined turns.

- 49** Rotate the point $(4, 2)$ **90° anticlockwise** about the centre $(1, 1)$.

- 50** Rotate the point $(5, 3)$ **180°** about the centre $(2, 1)$.

- 51 Rotate the point $(-1, 4)$ **90° anticlockwise** about the centre $(0, 2)$.

- 52 Rotate the point $(3, -2)$ **180°** about the centre $(1, -1)$.

- 53 Rotate the point $(6, 1)$ **90° clockwise** about the centre $(3, 3)$.

- 54 Rotate the point $(-2, -3)$ **90° anticlockwise** about the centre $(-1, -1)$.

- 55 A shape of area 20 is rotated 90° about $(3, 4)$. What is the area of the image?

- 56 A point is rotated 90° anticlockwise about the origin, then 90° anticlockwise again. Name the single transformation that does the same job.

D · Word problems — Clocks, robots, tiles and fairground rides.

- 57 A minute hand tip is at $(0, 5)$ on a clock face centred on the origin. It turns 90° clockwise. Where is the tip now?

- 58 A robot arm has its tool at $(3, 2)$ and pivots about the origin. It rotates 180° . Where is the tool?

- 59 A tile has a corner at $(2, 5)$. The tile is turned a quarter turn anticlockwise about the origin. Where is that corner?

- 60 A fairground ride seat is at $(6, 0)$. The ride turns 180° about its centre at $(2, 0)$. Where is the seat?

- 61 A logo is rotated four times by 90° about its centre. How many degrees has it turned altogether?

- 62 A pattern turns the point $(1, 3)$ by 90° anticlockwise about $(1, 1)$. Where does it land?

- 63 A square window frame is rotated 180° . How many of its sides have changed length?

- 64 A shape at $(4, 1)$ has an image at $(-4, -1)$ with the origin as centre. What angle was it turned through?
