

GCSE MATHS

Trigonometric graphs and transformations

Worked Solutions

Q1

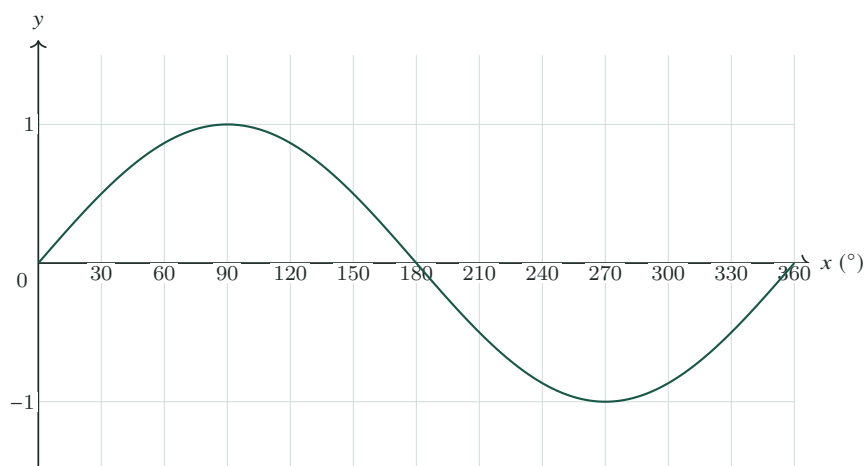
★

0, 1, 0, -1, 0

Read the five quarter-turn values.

Sketch shown below

Plot the key points and join with the appropriate shape.



Q2

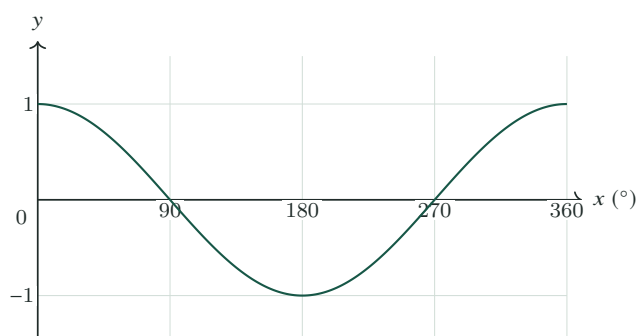
★★

(a) 1, 0, -1, 0, 1

Cosine starts at its maximum.

(b) 1, 0, -1, 0, 1

Plot these y-values at the quarter turns and join smoothly.



Q3

★★

$x = 180^\circ, 360^\circ$

Exclude both endpoints of the stated interval.

Q4

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(a) $y = -1$

Read the lowest point of the sine curve.

(b) $x = 270^\circ$

Read its position on the horizontal axis.

Q5

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$x = 180^\circ$

Cosine reaches its minimum halfway through the cycle.

Q6

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$\tan 45^\circ = 1$

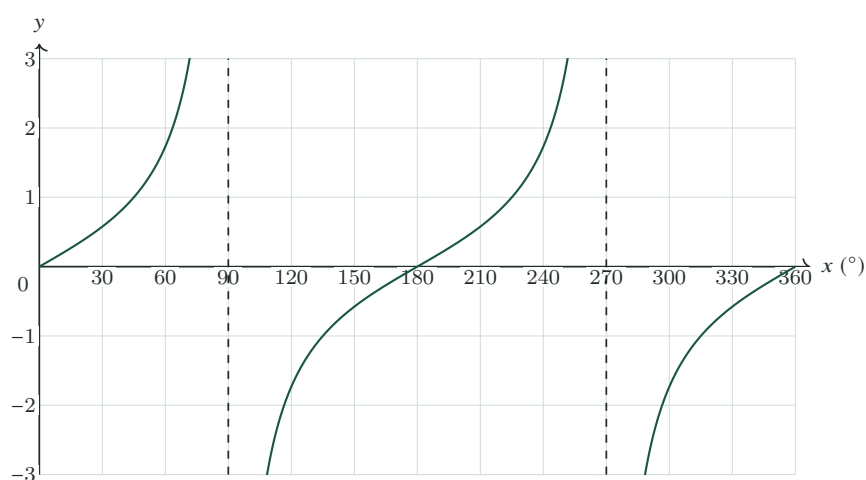
Opposite and adjacent sides are equal in a right isosceles triangle.

Q7

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$x = 90^\circ, 270^\circ$

Tangent is undefined at odd quarter turns.



Q8

$x = \sin^{-1}(0.5) = 30^\circ$

Find the first angle.

$x = 180^\circ - 30^\circ = 150^\circ$

Use sine symmetry for the second positive value.

Q9

$$x = \cos^{-1}(-0.5) = 120^\circ$$

Find the first angle.

$$x = 360^\circ - 120^\circ = 240^\circ$$

Use cosine symmetry.

Q10

$$x = 45^\circ$$

Use the exact first-quadrant value.

$$x = 45^\circ + 180^\circ = 225^\circ$$

Tangent repeats after 180° .**Q11**

$$x \approx 44.427^\circ$$

Use inverse sine in degree mode.

$$x \approx 135.573^\circ$$

Subtract the unrounded first angle from 180° .

$$x \approx 44^\circ, 136^\circ$$

Round both answers to the nearest degree.

Q12

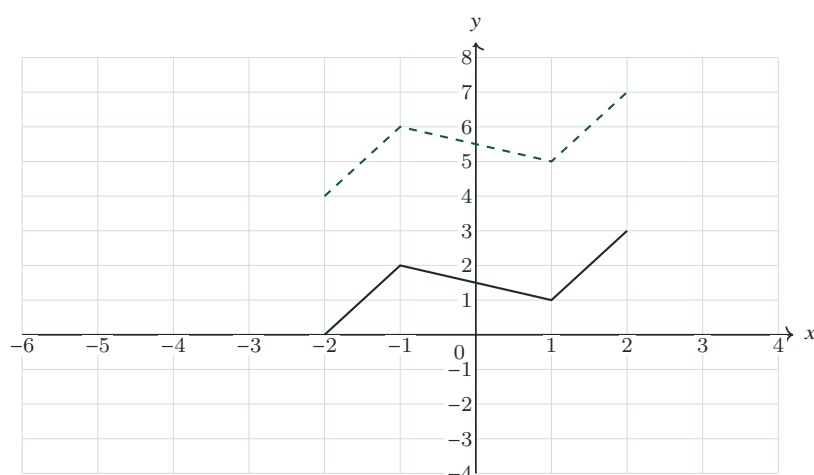
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Transform each vertex

Translation 4 units up.

Join corresponding vertices

Keep the straight segments. The transformed graph is dashed below.



Q13

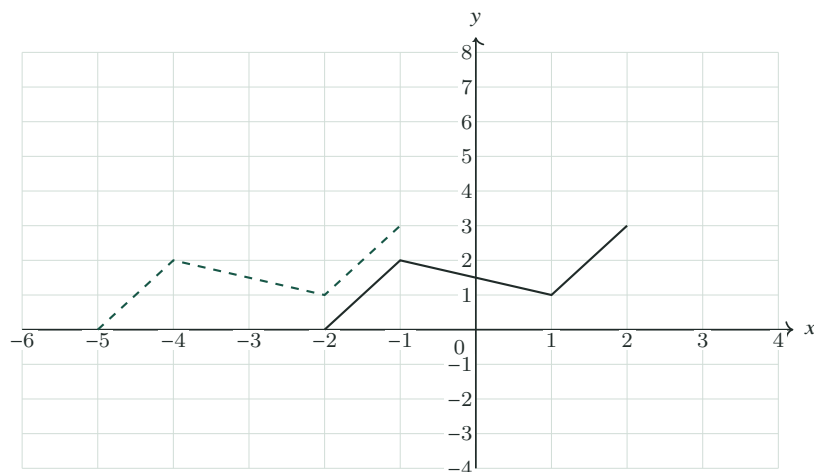
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Transform each vertex

Translation 3 units left.

Join corresponding vertices

Keep the straight segments. The transformed graph is dashed below.



Q14

$$(2 + 4, -3 + 2) = (6, -1)$$

Move right four and up two.

Q15

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

Move left two and down three.

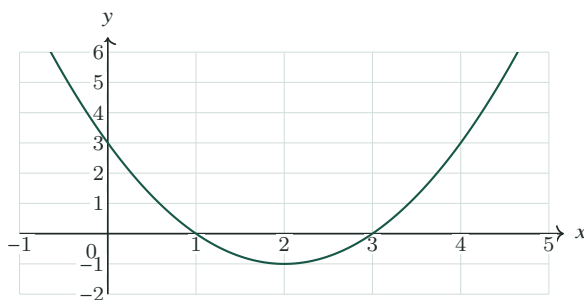
Q16

$$(2, -1)$$

Move the minimum of $y = x^2$ right two and down one.

$$(x - 2)^2 = 1 \Rightarrow x = 1, 3$$

Find the roots.



Q17

change in $x = 4$ change in $y = -2$

$$y = f(x - 4) - 2$$

Find the horizontal and vertical movements.

A right shift subtracts inside the function.

Q18

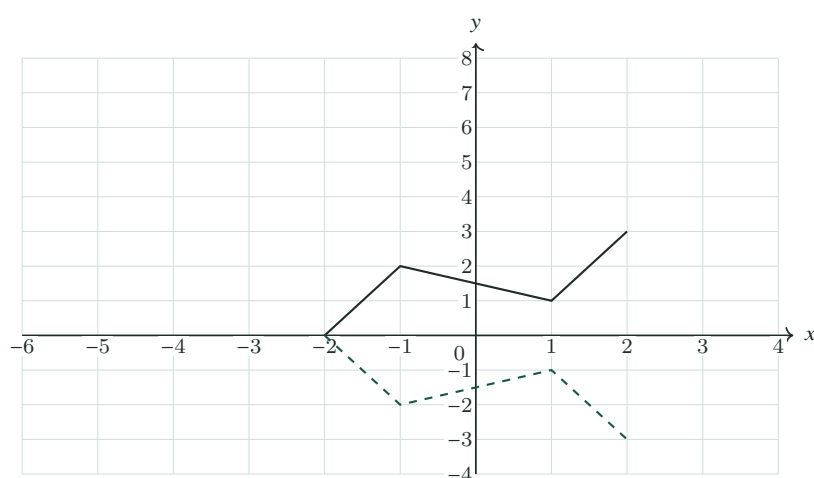
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Transform each vertex

Reflection in the x -axis.

Join corresponding vertices

Keep the straight segments. The transformed graph is dashed below.



Q19

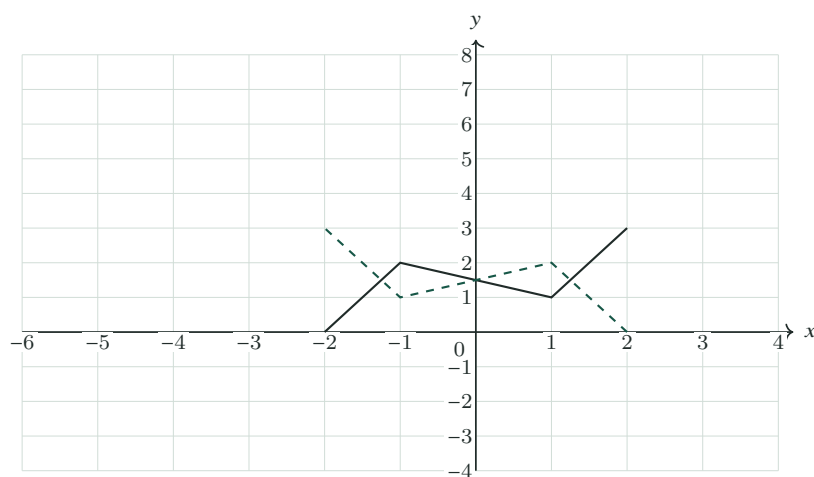
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Transform each vertex

Reflection in the y -axis.

Join corresponding vertices

Keep the straight segments. The transformed graph is dashed below.



Q20

$$(-2, 1) \mapsto (-2, -1)$$

Reflect in the x -axis, turning the minimum into a maximum.

$$(-2, -1 + 5) = (-2, 4)$$

Translate up five.

Q21

$$(4, -3) \mapsto (-4, -3)$$

Reflect in the y -axis.

$$(-4, -3) \mapsto (-4, 3) \mapsto (-4, 5)$$

Reflect in the x -axis, then move up two.

Q22

$$2 - x = -1 \Rightarrow x = 3$$

Match the first root input.

$$2 - x = 3 \Rightarrow x = -1$$

Match the second root input.

Q23

$$\cos x = -0.5$$

Subtract one and reverse the sign.

$$x = 120^\circ, 240^\circ$$

Use both intersections of cosine with -0.5 .