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YEAR 10 MATHS – GEOMETRY & ALGEBRA

TARGET GRADE 6

SUMMER LEARNING PROGRAMME

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 **Circumference and Area of a Circle**

**1.** A circular pond has a diameter of 6 m.
Calculate its circumference.

 (2 marks)

**2.** A circular pond has a radius of 2.2 m.

(a) Calculate the circumference of the pond.

 (2 marks)

(b) Calculate the area of the pond.

 (3 marks)

**3.** A semi-circular protractor has a diameter of 9 cm.



Calculate the perimeter in cm.

 (3 marks)

**4.** Jasmin has a pond in her garden.
The surface of the pond is a circle of diameter 6 metres.



 Calculate the area of a circle of diameter 6 metres.
Give your answer in terms of 

 (2 marks)

**5.** A circular photo frame is shown below.

 The diameter of the photo is 10 cm and the outer diameter of the frame is 18 cm.



 Calculate the area of the frame.

 (5 marks)

**6.** The diagram shows a circle of radius 6 cm.



 Work out the area of the circle.
Give your answer in terms of *.*

 (3 marks)

**7.** The diagram shows a circle which touches all four sides of a square.
The diameter of the circle is 11 cm.



 Calculate the total area of the shaded parts of the square (in cm2).
Give your Answer to a suitable degree of accuracy.

 (4 marks)

**Volume of a Prism**

**1.** The diagram shows two boxes that are cuboids.
The larger box measures 20 cm by 10 cm by 20 cm.
It is partly filled with 70 smaller boxes each measuring 5 cm by 5 cm by 2 cm.
The smaller boxes are packed so that there are no gaps between them.

Not drawn accurately



How many more smaller boxes could be fitted in the larger box?

 (4 marks)

**2.** The diagram shows a triangular prism.



 The area of the cross-section is 9.1 cm2.

 Work out the volume of the triangular prism (in cm3)

 (2 marks)

**3.** A cylindrical can of soup has a diameter of 7.5 cm.
It is 11.4 cm high.



Calculate the volume of the can.

 (4 marks)

**4.** The diagram shows a silver bar.



 The cross-section of the silver bar is a trapezium.



(a) Calculate the area of the cross-section (in cm2).

 (2 marks)

 (b) Calculate the volume of the silver bar (in cm3)

(2 marks)

**5.** The diagram shows a beam of uniform cross-section and length 4 metres.



 Calculate the volume of the beam.
Give your answer in cubic centimetres.

 (5 marks)

**6.** The sketch shows the entrance to a tunnel.
The uniform cross-section of the tunnel is in the shape of a semi-circle over a rectangle.



Not to scale

 The rectangle is 5 metres wide and 1.6 metres high.
The tunnel is 230 metres long.

 Calculate the volume of earth removed in digging the tunnel (in m3).

 (5 marks)

 **7.** A cylinder has a radius of 5 cm and a volume of 250 cm3.
Calculate the height of the cylinder.

 (3 marks)

**8.** A cylinder contains 17 litres of water.
The radius of the cylinder is 15 cm.

 Calculate the height of the water in the cylinder.

 (4 marks)

Quadratic Formula

**1.** Solve the equation

*x*2 – 10*x* – 5 = 0

 Give your answers to 2 decimal places.

 (3 marks)

**2.** Solve the equation

*x*2 + 8*x* – 5 = 0

 Give your answers to 2 decimal places.

 (3 marks)

**3.** Solve the equation

*x*2 – 2*x* – 5 = 0

giving your answers to 3 significant figures.

 (3 marks)

**4.** Solve the equation *x*2 + 4*x* – 10 = 0

 Give your answers to 2 decimal places.

 You **must** show your working.

 (3 marks)

**5.** Solve the equation



Give your answers to two decimal places.

You **must** show your working.

 (3 marks)

Pythagoras’ Theorem

**1.** The diagram shows a right-angled triangle *ABC*.

*AB* = 10 cm and *AC* = 15 cm



 Calculate the length of *BC*.
Leave your answer as a square root.

 (3 marks)

**2.** A rectangular field *ABCD* is shown.
The length of the field, *AB* = 160 m.
The width of the field, *BC* = 75 m.



Not to scale

(a) Calculate the length of the diagonal *BD*.

Give your answer to a suitable degree of accuracy (in m).

 (4 marks)

**3.** The diagram shows the points *A* (1, 3) and *B* (10, 5).



 Calculate the distance *AB.*Give your Answer to 2 decimal places.

 (5 marks)

**4.** *ABC* is a right-angled triangle.
*AC =* 19 cm and *AB =* 9 cm.



 Calculate the length of *BC* (in cm).

 (3 marks)

**5.** The diagram shows a cuboid.
*AB* = 3 cm, *AE* = 4 cm, *BC* = 12 cm.



Not drawn accurately

 Find the length of *BH* (in cm).

 (2 marks)

**6.** *PQR* is a right-angled triangle.
*PR* = 10 cm and *PQ* = 5 cm

Not drawn accurately 10 cm



 Calculate the length *QR* (in cm).

 (3 marks)

**7.** A right-angled triangle has the dimensions shown.

 Not drawn accurately

 Calculate the length *x*.
Give your answer to a suitable degree of accuracy (in cm).

 (4 marks)

**9.** *ABC* is a right-angled triangle.
*AB =* 15 cm, *AC =* 17 cm



 Calculate the length of the side *BC* (in cm)*.*

 (3 marks)

Trigonometry (Finding Unknown Sides)

**1.** The diagram shows a triangle *ABC*.
Angle *A* = 20° and angle *C* = 90°
*AB* = 32 m



Not drawn accurately

 Calculate the height *BC* (in m).

 (3 marks)

**2.** *ABC* is a right-angled triangle.
*AB* = 51 cm
Angle *CAB* = 48°



 Find the length of *BC*.
Give your answer to a suitable degree of accuracy (in cm).

(4 marks)

**3.** *ABC* is a right-angled triangle.
*BC* = 125 m.
Angle *CAB* = 33°.



 Find the length of *AC* (marked *x* in the diagram).
Give your answer to an appropriate degree of accuracy (in m).

 (4 marks)

**4.**

 Not drawn accurately

 Calculate the length *y* (in cm).

 (3 marks)

**5.** *ABC* is a right-angled triangle.
*AB =* 60 m
Angle *BAC =* 32°

**

 Find the length of *BC.*

 (3 marks)

Trigonometry (Finding Unknown Angles)

**1.** *PQ* is the surface of a ramp laid on level ground.
The ramp is 230 cm long and 20 cm high, as shown in the diagram.



 Work out the size of angle *x* (in degrees).

(3 marks)

**2.** For a ladder to be safe it must be inclined at between 70° and 80° to the ground.

The diagram shows a ladder resting against a wall.



Not to scale

 Is it safe?
You **must** show your working.

 (3 marks)

**3.** *PQR* is a right-angled triangle.
*PR* = 10 cm and *PQ* = 5 cm

Not drawn accurately



Calculate the size of angle *QPR* (in degrees).

 (3 marks)

**4.** A right-angled triangle has the dimensions shown.

 Not drawn accurately

 Calculate the size of angle *y* (in degrees).
Show your working.

 (3 marks)

**5.** A ramp is 4 metres long and 29 centimetres high.
If the ramp is safe for wheelchair users the angle marked *x* must be 4 or less.



 Is this ramp safe for wheelchair users?
You **must** show your working

 (4 marks)

**Interior and Exterior Angles in Polygons**

**1.** *ABCDE* is a regular pentagon.

Not drawn accurately



Calculate the size of each interior angle (in degree.

 (3 marks)

**2.** (a) The diagram below shows a regular hexagon.
One side has been extended and the **exterior** angle is *x*.

Not drawn accurately



 Explain why angle *x* is 60°.

 (1 mark)

(b) This diagram shows a regular octagon.
One of its **interior** angles is *y*.

Not drawn accurately



 Calculate the value of *y* (in degrees).

 (3 marks)

**3.** The diagram shows part of a regular polygon.

 Each interior angle is 162°.



 Calculate the number of sides of the polygon.

 (3 marks)

**4.** The diagram shows parts of two regular polygons *A* and *B*.

*A* has 12 sides and exterior angle 2*x*.

*B* has exterior angle 3*x*.

Not drawn accurately

3*x*

*B*

2*x*

*A*

Work out the number of sides of regular polygon *B*.

**5.** The diagram shows a regular octagon.



**Not drawn accurately**

 Calculate the size of the exterior angle of the regular octagon, marked *y* on the diagram.

 (2 marks)

**6.** *ABCD* is a quadrilateral.
The side *DC* is extended to *E.*



 Work out the value of *x* (degrees).

 (3 marks)

**7.** The diagram shows part of a regular polygon.

 Each interior angle is 162°.



 Calculate the number of sides of the polygon.

 (3 marks)

**8.** The diagram shows part of a regular polygon.
Each interior angle is 144°.



 Calculate the size of the exterior angle of the polygon (in degrees).

(2 marks)

**Circle Theorems**

**1.** *O* is the centre of the circle.



(i) Find the value of *x.*

 (1 mark)

 (ii) Find the value of *y.*

 (1 mark)

**2.**



(i) Write down the value of *x* (degrees).

 (1 mark)

(ii) Calculate the value of *y* (degrees).

 (1 mark)

**3.** (a) The diagram shows a circle with centre *O*.



 Work out the size of the angle marked *x* (degrees).

 (1 mark)

 (b) The diagram shows a different circle with centre *O*.



 Work out the size of the angle marked *y*.

 (1 mark)

 **4.***ABCD* is a cyclic quadrilateral.

Not drawn accurately

*B*

*C*

*D*

*A*

*x*

*y*

*y* − 45

2*x* + 15

 Work out the values of *x* and *y*.

 **(4 marks)**

**5*.*** *A, B* and *C* are points on the circumference of a circle with centre *O.
BD* and *CD* are tangents.
Angle *BDC =* 40°



 (i) Work out the value of *p* (degrees).

 (2 marks)

(ii) Hence write down the value of *q* (degrees).

 (1 mark)

**6.** (a) *O* is the centre of the circle.



 Calculate the value of *a*.

 (2 marks)

(b) *O* is the centre of the circle.
*A, B, C* and *D* are points on the circumference.
Angle *AOC =* 126°



(i) Calculate the value of *x* (degrees).

 (1 mark)

(ii) Calculate the value of *y* (degrees)*.*

 (1 mark)

**7.** *A*, *B*, *C* and *D* are points on the circumference of a circle centre *O*.
 *AOC* = 130°

 Not drawn accurately

 Work out the size of angles *ABC* and *ADC* (degrees).

(2 marks)

**8.** (a) In the diagram, *O* is the centre of the circle.



 Calculate the value of *a* (degrees)*.*

 (2 marks)

(b)



(i) Write down the value of *x* (degrees).

 (1 marks)

(ii) Calculate the value of *y* (degrees)*.*

 (1 mark)

**9.** (a) The diagram shows a circle with centre *O*.



 Work out the size of the angle marked *x* (degrees).

 (1 mark)

(b) The diagram shows a different circle with centre *O*.



 Work out the size of the angle marked *y* (degrees).

 (1 mark)

**10.** In the diagram, *O* is the centre of the circle.
*A, B, C* and *D* are points on the circumference.
Angle *AOC* = 130°



(a) Calculate the value of *x* (degrees). Give a reason for your answer.

 **(2 marks)**

(b) Calculate the value of *y* (degrees). Give a reason for your answer.

**(2 marks)**

**11.** (a) In the diagram, *O* is the centre of the circle.



 Write down the value of *a* (degrees).

 (1 mark)

(b)



 Write down the value of *b* (degrees)*.*

 (1 mark)

(c) In the diagram, *O* is the centre of the circle.



 Write down the value of *c* (degrees).

 (1 mark)

(d)



 Write down the value of *d* (degrees)*.*

 (1 mark)

**Quadratic Graphs**

**1.** (a) Complete the table of values for *y = x*2 *–* 3

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *x* | –3 | –2 | –1 | 0 | 1 | 2 | 3 |
| *y* |  | 1 | –2 | –3 | –2 |  | 6 |

 (1 mark)

(b) On the grid draw the graph of *y = x*2 *–* 3 for values of *x* from –3 to +3



(2 marks)

(c) Use the graph to solve the equation *x*2 *–* 3 = 0

 (2 marks)

**2.** (a) Complete the table of values for *y* = *x*2 – 4*x* + 3

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *x* | –1 | 0 | 1 | 2 | 3 | 4 | 5 |
| *y* | 8 | 3 | 0 | –1 |  | 3 | 8 |

(1 mark)

(b) On the grid below, draw the graph of *y* = *x*2 – 4*x* + 3 for values of *x* between –1 and +5.



(2 marks)

(c) Write down the solutions of *x*2 – 4*x* + 3 = 0

 (1 mark)

**3.** (a) Complete the table of values for *y* = *x*2 – 4*x* – 2

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *x* | –2 | –1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| *y* | 10 | 3 | –2 | –5 |  | –5 | –2 | 3 | 10 |

 (1 mark)

(b) On the grid below, draw the graph *y* = *x*2 – 4*x* – 2 for values of *x* between –2 and 6.



(2 marks)

 (c) Use your graph to write down the solutions of the equation *x*2 – 4*x* – 2 = 0

 (2 marks)

**Volume of prism** = area of cross-section × length

**Area of trapezium** = (*a* + *b*)*h*

*h*

*a*

*b*

length

cross-

section

**Formulae Sheet: Higher Tier**

**Volume of sphere** = π*r* 3

**Surface area of sphere** = 4π*r* 2

*r*

*r*

*h*

*l*

**Volume of cone** = π*r* 2 *h*

**Curved surface area of cone** = π*r* *l*

**In any triangle** *ABC*

**Area of triangle** = *ab* sin *C*

**Sine rule**  =  = 

**Cosine rule** *a* 2 = *b* 2 + *c* 2 – 2*bc* cos *A*

**The Quadratic Equation**

The solutions of *ax* 2 + *bx* + *c* = 0, where *a* ≠ 0, are given by

 *x* = 

*A*

*B*

*C*

*a*

*b*

*c*