

Additional Mathematics

Grade Gobbler 7

40 Mark Paper

Question 1

A cone's circular base, where x and y are in cm, is described by the equation

$$x^2 + y^2 + 6x - 14y = 6$$

- (i) Write the equation of the circular base in the form

$$(x - a)^2 + (y - b)^2 = r^2$$

[2 marks]

- (ii) The cone has a perpendicular height, h , of 13.5 cm.
Determine the volume of the cone, correct to 1 decimal place.

$$\text{Voume of a cone} = \frac{\pi}{3} r^2 h$$

[1 mark]

Question 2

By using Pascal's Triangle, or otherwise, expand the brackets;

$$\left(\frac{1}{3x} + x \right)^4$$

[3 marks]

Question 3

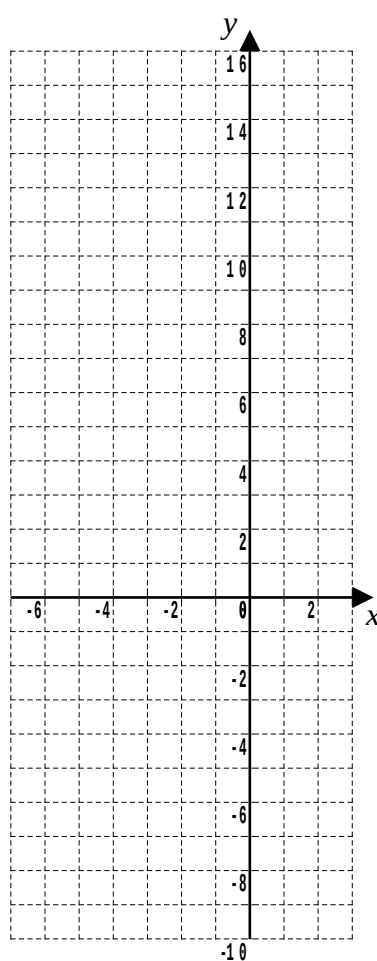
This question is about plotting the graph of the quadratic curve $y = x^2 + 4x - 5$ and then using the graph to solve an inequality.

- (i) Rajit has decided to make a table to assist him in determining some points on the quadratic curve $y = x^2 + 4x - 5$.
He has calculated that $(-6, 7)$ is on the curve.
Help Rajit by completing his table.

x	-7	-6	-5	-4	-3	-2	-1	0	1	2	3
x^2		36									
$4x - 5$		-29									
y		7									

[2 marks]

- (ii) Use the table to plot the quadratic curve $y = x^2 + 4x - 5$.
Place the equation of the curve next to the curve plotted.



[2 marks]

(iii) Factorise $x^2 + 4x - 5$

[1 mark]

(iv) There is a link between the graph of the curve $y = x^2 + 4x - 5$ and its factorisation.

Look at the curve carefully and try to spot the connection.
State the connection;

[1 mark]

(v) Explain the connection

[1 mark]

(vi) Solve the inequality $x^2 + 4x < 5$

[2 marks]

Question 4

Prove that $\frac{\sqrt{1 - \cos^2 \theta}}{\sqrt{1 - \sin^2 \theta}} = \tan \theta$

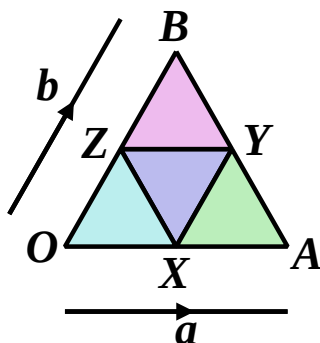
[2 marks]

Question 5

(Regular GCSE Revision Question)

The diagram below shows four congruent equilateral triangles arranged edge-to-edge to form a large equilateral triangle.

Notice that; $\vec{OA} = \mathbf{a}$
and; $\vec{OB} = \mathbf{b}$



Describe, in terms of the vectors $\mathbf{a}$ and $\mathbf{b}$, the following;

- | | | | | | |
|---------|------------|----------|------------|---------|------------|
| (i) | $\vec{OX}$ | (ii) | $\vec{AX}$ | (iii) | $\vec{ZB}$ |
| (iv) | $\vec{YZ}$ | (v) | $\vec{ZO}$ | (vi) | $\vec{BA}$ |
| (vii) | $\vec{ZX}$ | (viii) | $\vec{OY}$ | (ix) | $\vec{AZ}$ |

[3 marks]

Question 6

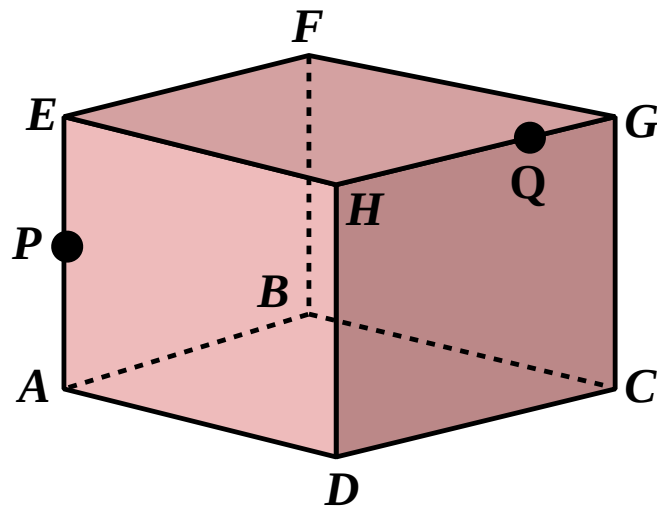
Differentiate, $y = \frac{4x^3 + 3x^5}{x^2}$

[2 marks]

Question 7

$ABCDEFGH$ is a cube of side 4 cm.

$AP = 2$ cm and $HQ = 3$ cm.



Calculate;

(i) the lengths of EQ and PD

[2 marks]

(ii) the length of PQ

[1 mark]

(iii) the angle between PQ and the plane $EFGH$

[2 marks]

(iv) the angle QPD

[3 marks]

Question 8

(i) Show that 144 is a factor of 1296

[1 mark]

(ii) Consider the graph of the equation,

$$y = 36x^4 - 648x^2 + 18$$

Determine $\frac{dy}{dx}$

[1 mark]

(iii) Hence determine all three turning points.

[3 marks]

(iv) Determine $\frac{d^2y}{dx^2}$

[1 mark]

(v) Hence, for each turning point, determine if it is a local minimum or or a local maximum.

[2 marks]

Question 9

Determine $\int_0^1 (x + 5)(2x^2 + 1) dx$

[2 marks]

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Teachers may obtain detailed worked solutions to the exercises by email from mhh@shrewsbury.org.uk