

# **AQA AS-Level Maths 2022 Paper 1**

Do not turn over the page until instructed to do so.

This assessment is out of 100 marks and you will be given 120 minutes.

When you are asked to by your teacher write your **full name** below

**Name:**

**Total Marks:**                      / 80



- 1 Find the area between the curve  $y = \frac{1}{4}(x + 4)(x - 3)(x + 2)$  and the  $x$ -axis.

$$\frac{407}{16}$$

$$\frac{-343}{16}$$

$$2$$

$$\frac{343}{16}$$

**[1 mark]**

- 2 Which of the following is a counter example the statement “ $x^3 + 3x - 5$  is always prime”

$$x = 6$$

$$x = 5$$

$$x = 3$$

$$x = 4$$

**[1 mark]**

- 3 Write as a single logarithm the following

$$10 \log_2(x) + 2 \log_2(yz^2) - 5 \log_2(xz)$$

**[3 marks]**

- 4     **a)**     Using the factor theorem, show that  $(x + 4)$  is a factor of the polynomial  $p(x) = 3x^3 + 14x^2 + 9x + 4$ .

**[2 marks]**

- b)**     Fully factorise  $p(x) = 3x^3 + 14x^2 + 9x + 4$ .

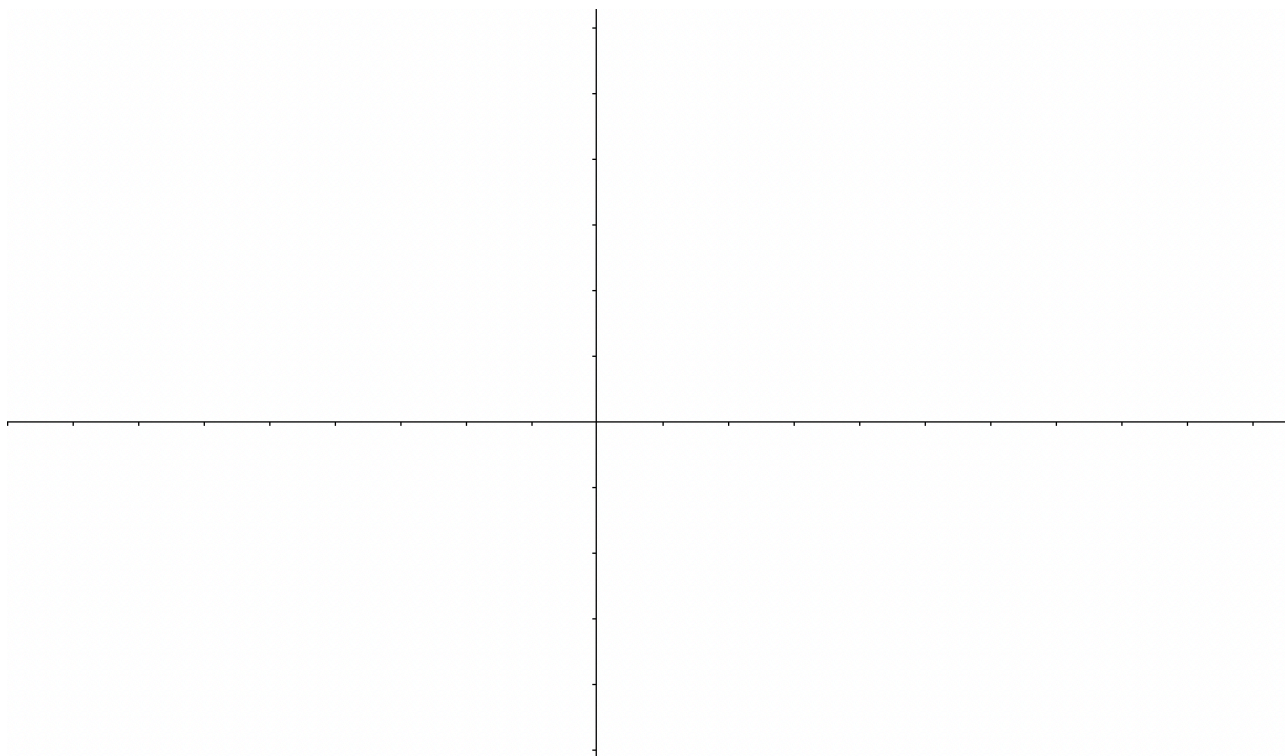
**[1 mark]**

- c)**     Hence, prove that  $p(x)$  has only one real root.

**[3 marks]**

- 5    **a)**    Sketch on the axes below  $y = \cos(x)$  and  $y = \cos(3x)$  for  $-360^\circ \leq x \leq 360^\circ$

**[3 marks]**



- b)**    How many solutions are there for the equation  $\cos(3x) = \frac{1}{3}$  in the interval  $0^\circ \leq x \leq 540^\circ$ ?

- 6 Consider the circle,  $C$ , given by
- $$C : x^2 + y^2 + 6x - 4y - 12 = 0$$

a) Find the centre of  $C$ .

[1 mark]

b) Find the radius of  $C$ .

[1 mark]

c) The line  $y = mx + 6$  is a tangent to the circle  $C$ . Find the value of  $m$ .

[4 marks]

- d)** Hence, find the area bounded by the tangent and the  $x$ – and  $y$ – axes.

**[3 marks]**

- 7 a)** Find the binomial expansion of  $(2 + 3x)^4$

**[4 marks]**

- b)** The coefficient of the  $x^2$  term in the expansion of  $(2 + 3x)^4$  is the same as that of the  $x$  term in the expansion of  $(2 + ax)^6$ . Find  $a$ .

**[2 marks]**

- 8 Solve, in the interval  $0^\circ \leq x \leq 360^\circ$ ,  
$$10 \sin^2(x) + 2 \cos^2(x) + 10 \sin(x) - 5 = 0$$

**[6 marks]**



- 9** The curve  $y = x^3 + px^2 - 5x + 7$  has a stationary point at  $x = 5$ .  
Find the value of  $p$  and classify the stationary point.

**[5 marks]**

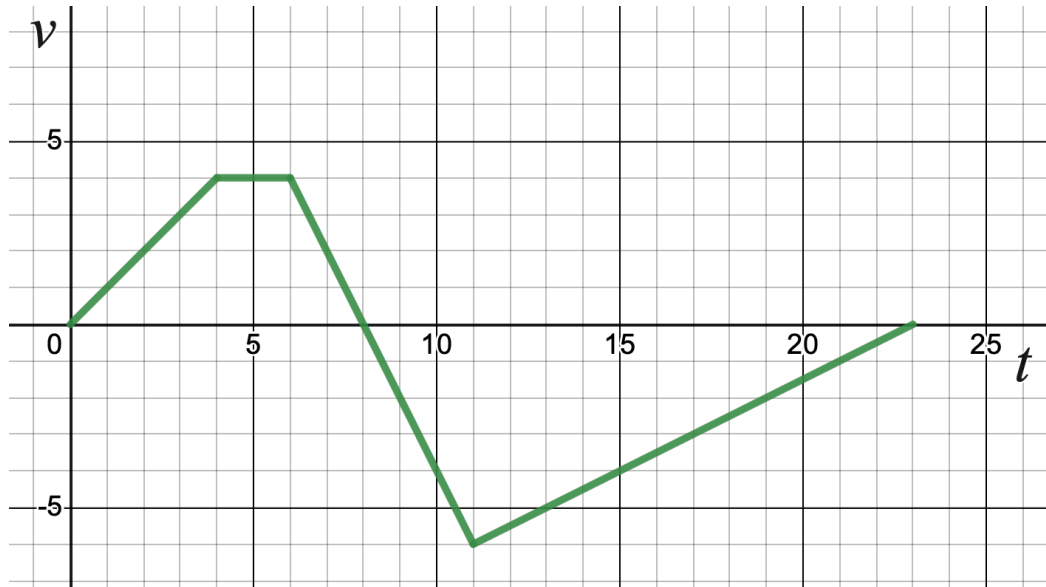
- 10** Consider the function  $f(x) = x^{\frac{3}{2}}(x^2 + 3) - 4x$ .

Find the vertical distance between the points where the tangent and normal to  $f(x)$  at  $x = 1$  intersects the  $y$ -axis.

**[10 marks]**

**Section B**

- 11** The velocity time graph below shows the velocity of a particle against time.



The total distance travelled is

0 m

−25 m

65 m

25 m

**12** A mass of 2 kg is acted on by a force  $\mathbf{F} = 5\mathbf{i} + 12\mathbf{j}$ .

**a)** Find the acceleration as a vector

**[2 marks]**

**b)** Find the magnitude of the acceleration.

**[2 marks]**

**c)** Find the direction of the acceleration relative to unit vector  $\mathbf{j}$ .

**[3 marks]**

- d) Compare the acceleration of this particle to one with acceleration  $-10\mathbf{i} - 24\mathbf{j} \text{ ms}^{-2}$ .

[1 mark]

- 13 Three forces,  $\mathbf{F}_1 = 2\mathbf{i} + 4\mathbf{j}$ ,  $\mathbf{F}_2 = a\mathbf{i} + 7\mathbf{j}$  and  $\mathbf{F}_3 = -8\mathbf{i} + b\mathbf{j}$ .

Given that resultant is  $\mathbf{R} = 6\mathbf{i} + 5\mathbf{j}$ , find  $a$  and  $b$ .

[3 marks]

- 14** A particle is projected vertically upwards with initial speed  $10 \text{ ms}^{-1}$ .  
Find how long the particle is above a height of 3 m.

**For this question use the acceleration due to gravity to be  $10 \text{ ms}^{-2}$ .**

**[3 marks]**

- 15** A particle of mass  $(3 + m)$  kg is connected by a light inextensible string to another particle of mass 5 kg.

The string is then placed over a smooth pulley and the system is held at rest.

- a)** Show that, when released, the acceleration felt by the particles has magnitude  $a = \frac{(2 - m)g}{8 + m}$ .

**[3 marks]**

- b)** How have you used the fact that the pulley is smooth in your working above?

**[1 mark]**

- 16** A particle is moving in a horizontal straight line from  $A$  to  $B$ . It takes 6 seconds to move the 30 m from  $A$  to  $B$ . At  $B$  the velocity of the particle is  $2 \text{ ms}^{-1}$ .

**a)** Find the velocity of the particle at  $A$ .

**[3 marks]**

**b)** Find the acceleration experienced by the particles as it moves from  $A$  to  $B$ .

**[3 marks]**



**17** A block of mass 3 kg is moving with velocity  $v(t) = 2e^{3t} + t$ .

**a)** Find the acceleration when  $t = 2$  s.

**[2 marks]**

**b)** What is the force experienced by the particle at this instant?

**[2 marks]**