2021 ASSESSMENT MATERIALS

AS
MATHS

Algebra and Functions (Topic B)

Total number of marks: 39

1 Identify the expression below that is equivalent to $e^{\frac{-2}{5}}$

Circle your answer.

[1 mark]

$$\frac{1}{\sqrt[5]{e^2}} \qquad -\sqrt{e^5} \qquad -\sqrt[5]{e^2} \qquad \frac{1}{\sqrt{e^5}}$$

2 It is given that $y = \frac{1}{x}$ and $x < -1$

Determine which statement below fully describes the possible values of y.

Tick (✓) **one** box.

[1 mark]

$-\infty < y < -1$ ☐

$y > -1$ ☐

$-1 < y < 0$ ☐

$y < 0$ ☐

3 It is given that $(x + 1)$ and $(x - 3)$ are two factors of $f(x)$, where

$$f(x) = px^3 - 3x^2 - 8x + q$$

3 (a) Find the values of p and q.

[3 marks]

3 (b) Fully factorise $f(x)$.

[2 marks]

4 Show that $\frac{\sqrt{6}}{\sqrt{3} - \sqrt{2}}$ can be expressed in the form $m\sqrt{n} + n\sqrt{m}$, where m and n are integers.

Fully justify your answer.

[4 marks]

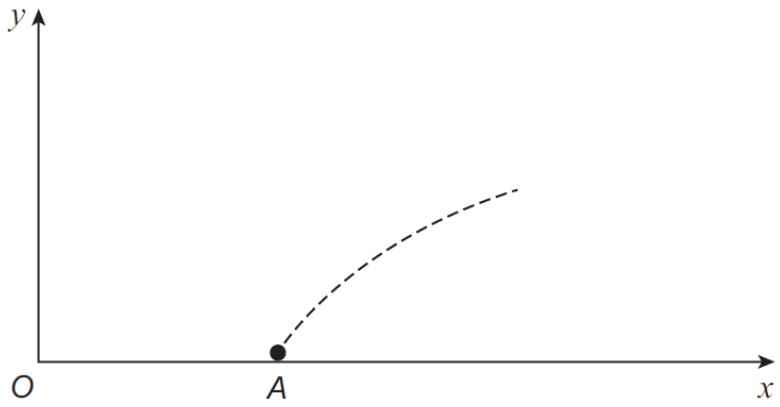
5 (a) Sketch the curve $y = g(x)$ where

$$g(x) = (x + 2)(x - 1)^2$$

[3 marks]

11 A fire crew is tackling a grass fire on horizontal ground.

The crew directs a single jet of water which flows continuously from point *A*.



The path of the jet can be modelled by the equation

$$y = -0.0125x^2 + 0.5x - 2.55$$

where x metres is the horizontal distance of the jet from the fire truck at *O* and y metres is the height of the jet above the ground.

The coordinates of point *A* are $(a, 0)$

11 (a) (i) Find the value of a.

[3 marks]

11 (a) (ii) Find the horizontal distance **from *A*** to the point where the jet hits the ground.

[1 mark]

11 (b) Calculate the maximum vertical height reached by the jet.

[4 marks]

11 (c) A vertical wall is located 11 metres horizontally from *A* in the direction of the jet. The height of the wall is 2.3 metres.

Using the model, determine whether the jet passes over the wall, stating any necessary modelling assumption.

[3 marks]

7 Given that $y \in \mathbb{R}$, prove that

$$(2 + 3y)^4 + (2 - 3y)^4 \geq 32$$

Fully justify your answer.

[6 marks]

7 Curve C has equation $y = x^2$

C is translated by vector $\begin{bmatrix} 3 \\ 0 \end{bmatrix}$ to give curve C_1

Line L has equation $y = x$

L is stretched by scale factor 2 parallel to the x-axis to give line L_1

Find the exact distance between the two intersection points of C_1 and L_1

[6 marks]