

- 1 Which group of 3 numbers could be roots of the polynomial equation $x^3 + 17x^2 - bx - 80 = 0$? 1
- (A) 10, 3, 4
(B) 13, 7, -3
(C) -5, -4, 4
(D) -20, -1, 4

- 2 Differentiate $x \sin^{-1}(ex)$ with respect to x . 2

- 3 Use the substitution $u = \sqrt{x}$ to determine: 2

$$\int_1^3 \frac{1}{(1+x)\sqrt{x}} dx$$

Give your answer in exact form.

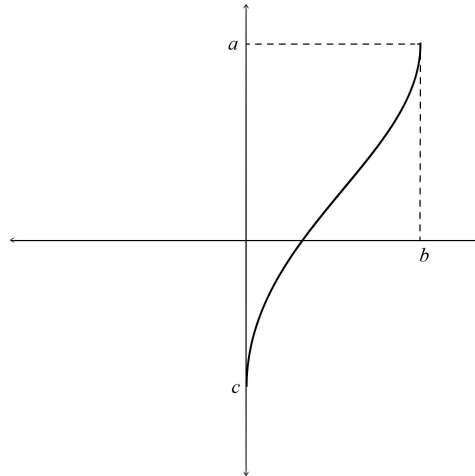
- 4 Use mathematical induction to prove $3^n + 7 < 4^n$ for all integers $n \geq 3$. 2

- 5 The polynomial $P(x) = x^3 + 2ax - b$ has a remainder of 6 when divided by $(x - 1)$ and a remainder of 4 when divided by $(x + 1)$. 2

Find the values of a and b .

- 6 Solve the inequality $\frac{2x(x-4)}{x-1} \leq 7$ 2

- 7 The graph of $y = 1 + 2\sin^{-1}(3x - 1)$ is shown below.



Find the values of a , b and c .

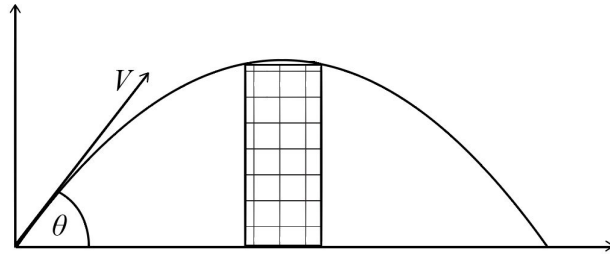
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- 8 A test consists of six multiple choice questions. Each question has four possible answers to choose from and only one of these answers is correct for each question.

Fatima randomly selects an answer to each of the six questions.

- (a) What is the probability that Fatima gets every question correct? Leave your answer in scientific notation correct to 3 significant figures. 1
- (b) What is the probability that Fatima gets four or more correct answers? 2
- (c) What is the probability that Fatima gets AT LEAST two correct answers 2
- 9 What is the value of $\lim_{x \rightarrow 7} \frac{3 \sin(x - 7)}{(x - 7)(x - 2)}$? 1

- 10 A ball is fired from the origin over a wall with initial velocity V m/s at an angle θ to the horizontal.



The ball only just clears both edges of the wall, as shown in the diagram. The equations of motion of the projectile are

$$x = Vt \cos \theta \quad \text{and} \quad y = Vt \sin \theta - \frac{g}{2}t^2 \quad (\text{Do NOT prove this})$$

- (a) Show that the horizontal range R of the ball is $\frac{V^2 \sin 2\theta}{g}$. 2
- (b) Hence show that the equation of the path of the ball is 2

$$y = x \left(1 - \frac{x}{R} \right) \tan \theta$$

- (c) The ball is fired at 45° and the wall is 8 metres high. Show that the x -coordinates of the edges of the wall are the roots of the equation 1

$$x^2 - Rx + 8R = 0$$

- (d) If the wall is 2 metres thick, find the value of R , correct to the nearest whole number. 2