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Year 12 Mathematics

Test 1

Time Allowed: 1 Hour

Total Marks: 50

31 October 2021

Calculator Allowed

Full Name of Student:

1.

$$x^2 + 2x + 3 \equiv (x + a)^2 + b.$$

- (a) Find the values of the constants a and b . (2)
- (b) Sketch the graph of $y = x^2 + 2x + 3$, indicating clearly the coordinates of any intersections with the coordinate axes. (3)
- (c) Find the value of the discriminant of $x^2 + 2x + 3$. Explain how the sign of the discriminant relates to your sketch in part (b). (2)

The equation $x^2 + kx + 3 = 0$, where k is a constant, has no real roots.

- (d) Find the set of possible values of k , giving your answer in surd form. (4)

[Total for Question 1 = 11 marks]

2.

The polynomial $p(x)$ is given by

$$p(x) = x^3 + x^2 - 10x + 8$$

- (a) (i) Using the factor theorem, show that $x - 2$ is a factor of $p(x)$. (2 marks)
- (ii) Hence express $p(x)$ as the product of three linear factors. (3 marks)
- (b) Sketch the curve with equation $y = x^3 + x^2 - 10x + 8$, showing the coordinates of the points where the curve cuts the axes. (4 marks)

[Total for Question 2 = 9 marks]

3.

Solve the equation $x^{\frac{2}{3}} + 3x^{\frac{1}{3}} - 10 = 0$.

[3]

[Total for Question 3 = 3 marks]

4.

Find the set of values of x for which

(a) $3(2x + 1) > 5 - 2x$, (2)

(b) $2x^2 - 7x + 3 > 0$, (4)

(c) **both** $3(2x + 1) > 5 - 2x$ **and** $2x^2 - 7x + 3 > 0$. (2)

[Total for Question 4 = 8 marks]

5.

(i) Find the first four terms of the expansion, in ascending powers of x , of $(1 - 2x)^{12}$. [4]

(ii) Hence find the coefficient of x^2 in the expansion of

$$(1 + 3x)(1 - 2x)^{12}.$$
[3]

(iii) Use your expansions in part (i) to find an estimate for the value of 0.98^{12} . [2]

[Total for Question 5 = 9 marks]

6.

(a) (i) Show that the equation

$$3 \cos^2 \theta = \sin \theta + 1$$

can be expressed in the form

$$3 \sin^2 \theta + \sin \theta - 2 = 0.$$
[2]

(ii) Hence solve the equation

$$3 \cos^2 \theta = \sin \theta + 1,$$

giving all values of θ between 0° and 360° . [5]

(b) Solve the equation $\sin(\theta - 30^\circ) = 0.7$, giving your answers to the nearest 0.1° in the interval $0^\circ \leq \theta \leq 360^\circ$. [3]

[Total for Question 6 = 10 marks]

- End of Test -
