

1. Write down the binomial expansion of $(1 - 2x)^6$ in ascending powers of x up to and including the term in x^3 . (4 marks)

2. Given that $f(x) = 4x + \frac{1}{x}$, for $x > 0$,
find the set of values of x for which $f(x)$ is increasing. (5 marks)

3. The first two terms of a geometric sequence are 10935, 3645.

(a) Find the exact value of the 11th term. (2 marks)

(b) Find the sum of the first nine terms, giving your answer to 2 decimal places. (2 marks)

(c) Find the sum to infinity of the sequence. (1 mark)

4. (a) Express $\frac{x^{\frac{5}{2}} + 1}{x^2}$ in the form $x^a + x^b$, where a and b are constants. (2 marks)

(b) Hence show that $\int_1^4 \left(\frac{x^{\frac{5}{2}} + 1}{x^2} \right) dx = \frac{65}{12}$ (5 marks)

5. (a) Express each of the following in terms of $\log_3 a$,

(i) $\log_3(a^4)$ (1 mark)

(ii) $\log_3(9a^2)$ (3 marks)

(b) Given that $b^2 = 8$, find the value of $\log_2 b$. (3 marks)

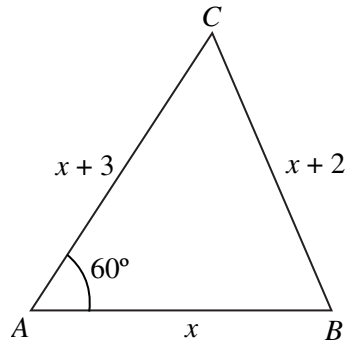
6. $f(x) = \sin 2x$, $0 \leq x \leq \pi$.

(a) Sketch the curve $y = f(x)$, giving the coordinates of the points where the curve meets the x -axis. (4 marks)

(b) Solve the equation $\sin 2x = \frac{1}{2}$, giving your answers in terms of π . (4 marks)

7. The first three terms of an arithmetic series are x , $4x - 9$ and $5x$ respectively.
- (a) Show that $x = 9$. (2 marks)
- (b) Find the value of the 51st term of this series. (3 marks)
- (c) Show that the sum of the first n terms of the series is $9n^2$. (4 marks)

8.



The diagram shows triangle ABC in which $AB = x$, $AC = x + 3$, $BC = x + 2$ and $\angle BAC = 60^\circ$.

- (a) Use the cosine rule to find the value of x . (5 marks)
- (b) Hence find the area of triangle ABC , giving your answer in the form $k\sqrt{3}$. (4 marks)
9. (a) Find $\frac{dy}{dx}$ in each of the following cases:
- (i) $y = \frac{1}{4}x + \frac{4}{x}$ (2 marks)
- (ii) $y = x^2(x - 4)$ (3 marks)
- (iii) $y = 2\sqrt{x} + \sqrt{2}$ (2 marks)
- (b) The equation of a curve is $y = 3x + \frac{1}{x^2}$.

Find the coordinates of the point on the curve where the gradient of the curve is equal to 1. (4 marks)

10. (a) Given that $16 = 2^m$, write down the value of m . (1 mark)

(b) Given that $4^n = 8^{3-n}$, find the value of n . (4 marks)

(c) (i) Given that $u^{\frac{1}{4}} = y$, show that the equation

$$u^{\frac{1}{4}} = 2 + 3u^{-\frac{1}{4}}$$

may be written as

$$y^2 - 2y - 3 = 0. \quad (3 \text{ marks})$$

(ii) Hence solve the equation $u^{\frac{1}{4}} = 2 + 3u^{-\frac{1}{4}}$. (2 marks)