

1. (a) Simplify $(2\sqrt{3})^3$ (1 mark)
- (b) Simplify $(3\sqrt{2} + 1)(\sqrt{2} - 1)$ (1 mark)
- (c) Express $\frac{\sqrt{2}}{\sqrt{2} + 1}$ in the form $a + b\sqrt{2}$, where a and b are integers to be determined. (3 marks)

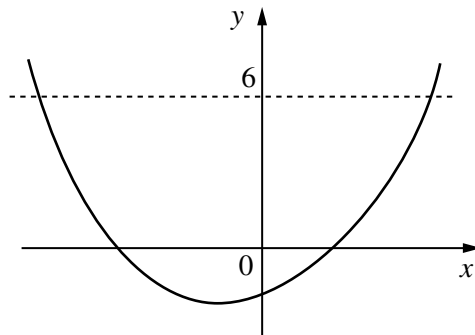
2. Solve the simultaneous equations

$$y = 7 - 3x$$

$$xy + 12 = 2x \quad (5 \text{ marks})$$

3. The equation of a curve is $y = x^2 + 3x - 4$.

Find the gradient of the curve at the two points where the curve meets the line $y = 6$.



(6 marks)

4. The equation $x^2 + mx + m = 0$ has no real roots for x .

Find the set of values that m can take. (5 marks)

5. Given that

$$\frac{dy}{dx} = 10x^4 + 3$$

and that $y = 2$ when $x = 1$, find the value of y when $x = -1$. (6 marks)

6. Given that $f(x) = 12 + 5x - 2x^2$
- (a) find the coordinates of all points at which the graph of $y = f(x)$ crosses the coordinate axes. (3 marks)
- (b) Sketch the graph of $y = f(x)$. (2 marks)
- (c) The graph of $y = f(x)$ is obtained from the graph of $y = 5x - 2x^2$ by a single transformation. Describe the transformation fully. (2 marks)

7.
$$f(x) = x^3 + ax^2 + bx - 4$$

When $f(x)$ is divided by $(x - 1)$ the remainder is -4 . Also $(x - 2)$ is a factor of $f(x)$.

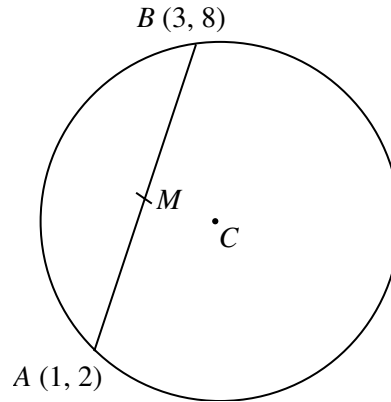
- (a) Find the value of a and the value of b . (4 marks)
- (b) Express $f(x)$ as a product of a linear factor and a quadratic factor. (3 marks)
- (c) Hence determine the number of real roots of the equation $f(x) = 0$. Explain your answer. (3 marks)
8. Given that $f(x) = x \left(x^{\frac{1}{2}} - 2x^{-\frac{1}{2}} \right)^2$, $x > 0$,

- (a) find the value of x for which $f(x) = 0$. (2 marks)
- (b) Show that $f(x)$ may be written in the form $ax^2 + bx + c$, where a , b and c are constants to be found. (3 marks)

(c) Show that $\int_{\frac{1}{2}}^1 f(x) dx = \frac{19}{24}$. (4 marks)

9.

Figure 1



The points A and B have coordinates $(1, 2)$ and $(3, 8)$ respectively, and AB is a chord of a circle with center C , as shown in Fig. 1.

(a) Find the gradient of AB . (2 marks)

The point M is the mid-point of AB .

(b) Find an equation for the line through C and M . (4 marks)

Given that the y -coordinate of C is 4,

(c) find the x -coordinate of C , (2 marks)

(d) show that the radius of the circle is $2\sqrt{5}$. (4 marks)

10. A curve has the equation $y = x^2 - x$.

The point P on the curve has x -coordinate 1.

(a) Find an equation for the normal to the curve at P , giving your answer in the form $y = mx + c$. (6 marks)

(b) Find the coordinates of the point where the normal to the curve at P intersects the curve again. (4 marks)