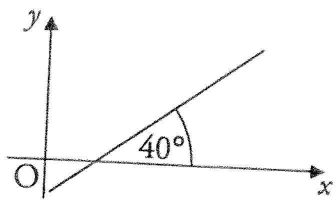
Higher Maths
Unit 1 Specimen NAB
Number 2

Outcome 1 — **Marks**

1. A line passes through the points (4, -3) and (-6, 2).
   Find the equation of this line. 2

2. A line makes an angle of 40^0 with the positive direction of the x-axis, as shown in the diagram.

   The scales on the axes are equal.

   Find the gradient of the line giving your answer correct to 3 significant figures. 2

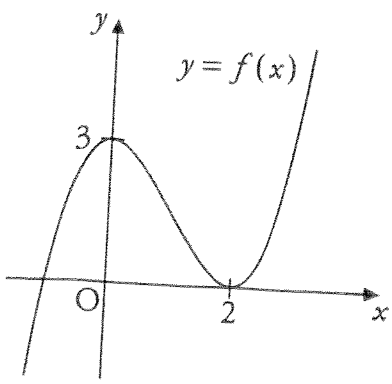
3. A line L has equation $y = 4x + 1$
   Write down the gradient of a line which is:

   (a) parallel to L 1

   (b) perpendicular to L 1

Outcome 2

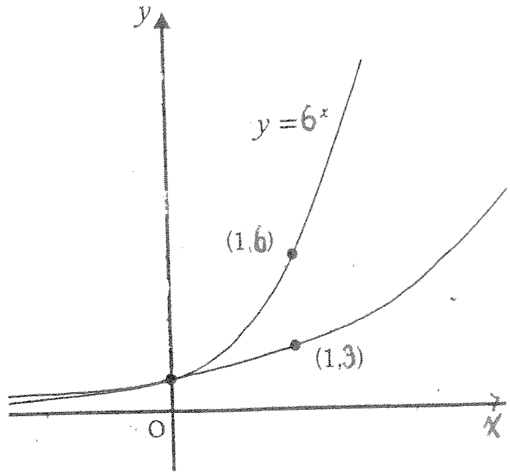
4. The graph of $y = f(x)$ is shown.

   On separate diagrams sketch the graphs of

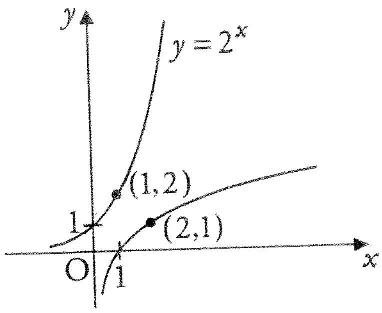
   (a) $y = -f(x)$ 2
   (b) $y = f(x + 4)$ 2

5. The graphs with equations $y = 6^x$ and $y = a^x$ are shown in the diagram.



If the graph of $y = a^x$ passes through the point (1, 3), find the value of a. 1

6. The graphs of $y = 2^x$ and its inverse function are shown in the diagram.



Write down the equation of the inverse function. 1

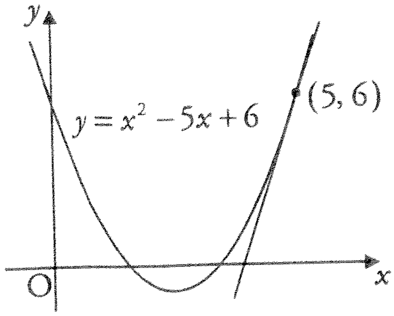
7. Functions g and h are defined on suitable domains by f(x) = x^3 and g(x) = 2x – 4.

Obtain an expression for f(g(x)). 2

Outcome 3

8. Given that y = $\dfrac{-3}{x^3}$, $x \neq 0$, find $\dfrac{dy}{dx}$. 2

9. A sketch of the curve with equation $y = x^2 - 5x + 6$ is shown in the diagram.



A tangent has been drawn at the point (5, 6).

Find the gradient of the tangent. 3

10. A curve has equation $y = \frac{1}{3}x^3 - 4x^2 + 12x - 3$.

Using differentiation find the coordinates of the stationary points on this curve and determine their nature. 6

Outcome 4

11. A pond is treated weekly with a chemical to ensure that the number of bacteria is kept low. It is estimated that the chemical kills 68% of all bacteria. Between the weekly treatments, it is estimated that 600million new bacteria appear.

There are u_n million bacteria at the start of a particular week.

(a) Write down a recurrence relation for u_{n+1}, the number of millions of bacteria at the start of the week. 1

(b) (i) Find the limit of the sequence generated by this recurrence relation as $n \to \infty$.

(ii) Explain what this limit means in the context of this problem. 3