Calderglen High School
Mathematics Department

Higher Mathematics

Unit 1 : Practice Assessment

Read carefully

1. **Calculators may be used in this paper.**
2. **Full credit will be given only where the solution contains appropriate working.**
3. **Answers obtained by readings from scale drawings will not receive any credit.**

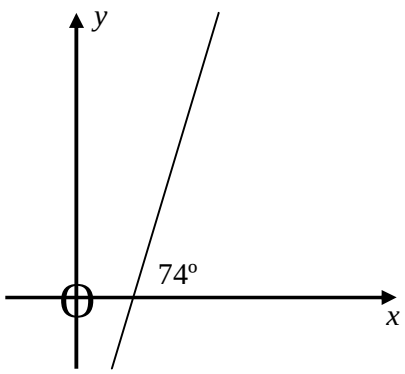
Outcome 1 : Properties of a straight line

1. A line passes through the points A(-1,5) and B(1,1).
   Find the equation of the line AB. **2**

2. A line makes an angle of 74º 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 $y = -2x + 4$.

   Write down the gradient of a line which is:

   (a) parallel to L **1**

   (b) perpendicular to L **1**

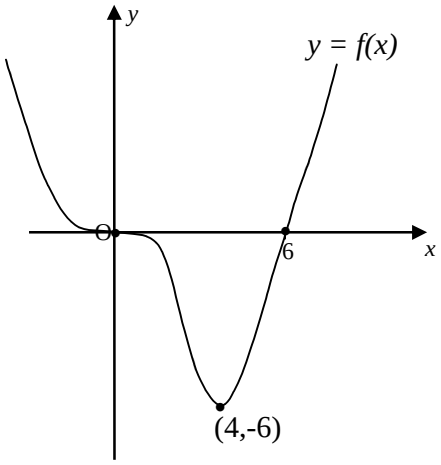
Outcome 2 : Associated graphs

4. The diagram opposite shows the graph of a cubic $y = f(x)$.

   On separate diagrams draw the graphs of

   (a) $y = -f(x)$ **2**

   (b) $y = f(x - 3)$ **2**

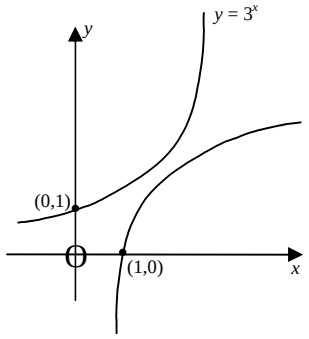


5. If the graph with equation $y = a^x$ passes through the point (2,9), find the value of a. **1**

Outcome 2 : Associated graphs - continued

6. The diagram opposite shows part of the graph of the function $y = 3^x$ and its inverse function.

   Write down the equation of the inverse function.



1

7. Two functions f and g are given by $f(x) = x^4$ and $g(x) = 3x + 2$.

   Obtain an expression for $f[g(x)]$

2

Outcome 3 : Use basic differentiation

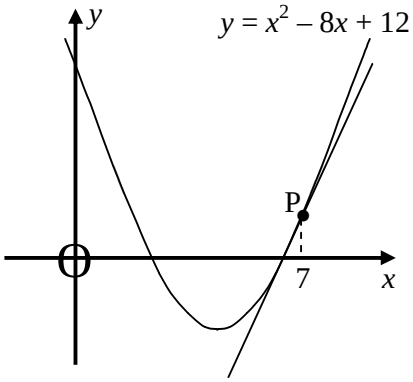
8. Given that $y = \dfrac{6}{x^5}$ find $\dfrac{dy}{dx}$.

2

9. The diagram shows a sketch of the curve with equation $y = x^2 - 8x + 12$.

   A tangent has been drawn at the point P(7,5).

   Find the gradient of the tangent at P.



3

10. A curve has equation

$$y = 4x^3 - 9x^2 + 6x$$

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

6

Outcome 4 : Design and interpret mathematical models of situations involving recurrence relations

12. A reservoir is polluted by a chemical discharge from a neighbouring factory.
At the beginning of each week 38% of the pollution is removed. During the week 9 tonnes of chemical discharge is added to the reservoir.

There are U_n tonnes of chemical discharge, in the reservoir, at the start of a particular week.

(a) Write down a recurrence relation for U_{n+1}, the number of tonnes of chemical discharge, in the reservoir, at the start of the next week. **1**

(b) The amount of pollution in the reservoir becomes critical if it exceeds 20 tonnes.

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

(ii) In the long term, will the amount of pollution in the reservoir become critical? **3**

End of Question Paper