Higher Maths - September Assessment

Trigonometric formulae:

$$\sin (A \pm B) = \sin A \cos B \pm \cos A \sin B$$
$$\cos (A \pm B) = \cos A \cos B \mp \sin A \sin B$$
$$\sin 2A = 2\sin A \cos A$$
$$\cos 2A = \cos^2 A - \sin^2 A$$
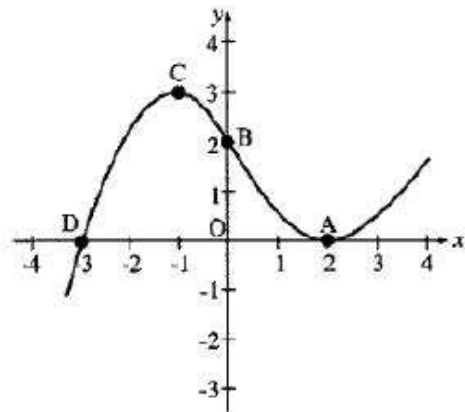$$= 2\cos^2 A - 1$$
$$= 1 - 2\sin^2 A$$

1 Part of the graph of $y = f(x)$ is shown in the diagram.
On separate diagrams sketch the graphs of
  (i) $y = f(x-1)$
  (ii) $y = -f(x) - 2$
indicating on each graph the images of A, B, C and D.

5

2 Show that $2\cos(x° + 30°) - \sin x°$ can be written as $\sqrt{3}\cos x° - 2\sin x°$.

3

3 Express $\sqrt{3}\cos x° - 2\sin x°$ in the form $k\cos(x° + a°)$ where $k > 0$ and $0 \le \alpha \le 360$ and find the values of k and α.

3

4 (a) Write the expression $3x^2 + 12x - 5$ in the form $a(x + b)^2 + c$

3

   (b) Hence sketch $y = 3x^2 + 12x - 5$ and clearly mark the y-intercept and minimum   turning point
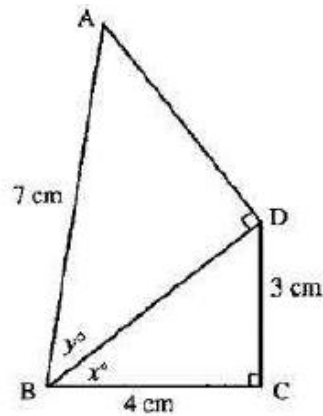
2

5 Find x if $4\log_x 6 - 2\log_x 4 = 1$.

3

6 The diagram shows two right-angled triangles ABD
   and BCD with AB = 7cm, BC = 4cm and CD = 3cm.
   Angle DBC = $x°$ and angle ABD = $y°$.

   Show that the exact value of $\cos(x+y)°$ is $\dfrac{20-6\sqrt{6}}{35}$.

3

7 The amount A grams of a radioactive substance at time t minutes is given by $A = A_0 e^{-kt}$ where A_0 is
   the initial amount of the substance and k is a constant.
   In 3 minutes, 10 grams of the substance Bismuth are reduced to 9 grams through radioactive decay.
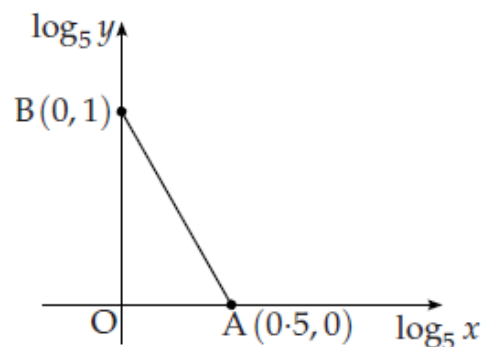
   3

   (a) Find the value of k.

   The half-life of a substance is the length of time in which half the substance decays.

   2

   (b) Find the half-life of Bismuth.

8 The graph illustrates the law $y = kx^n$.

   If the straight line passes through
   A $(0{\cdot}5, 0)$ and B $(0, 1)$, find the values of
   k and n.

4

Total marks available 31