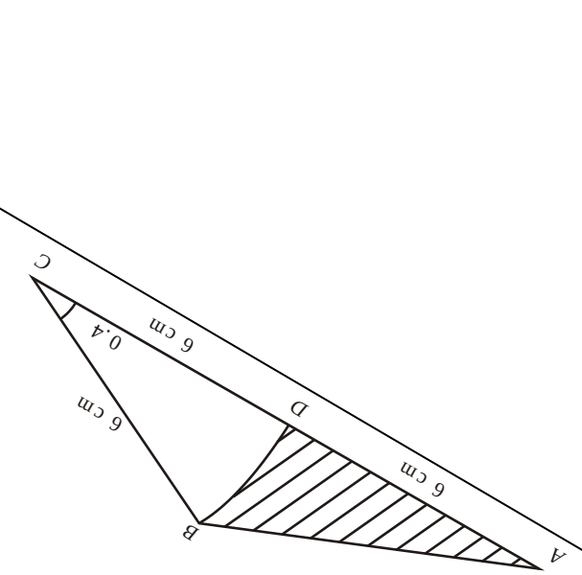
Power Hour

The diagram shows a logo ABD. The logo is formed from triangle ABC. The mid-point of AC is D and $BC = AD = DC = 6$ cm. $\angle BCA = 0.4$ radians. The curve BD is an arc of a circle centre C & radius 6 cm.

(a) Write down the length of the arc BD. (1)

(b) Find the length of AB. (3)

c) Write down the perimeter of the logo ABD, giving your answer to 3 s.f. (1)



(a) Find $\int 3 + 4x^3 - \frac{2}{x^2} \cdot dx$ **(3)**

(b) Hence $\int_1^2 3 + 4x^3 - \frac{2}{x^2} \cdot dx$ **(2)**

For the binomial expansion, in descending powers of x, of $(x^3 - \frac{1}{2x})^{12}$,

(a) find the first 4 terms, simplifying each term. (5)

(b) Find, in its simplest form, the term independent of x in this expansion. (3)

(a) Given that $3 \sin x = 8 \cos x$, find the value of $\tan x$. (1)

(b) Find, to 1 decimal place, all the solutions of $3 \sin x - 8 \cos x = 0$ in the interval $0 \leq x < 360°$. **(3)**

Solve $2 \log_3 x - \log_3 (x - 2) = 2$, $x > 2$.

The second and fifth terms of a geometric series are 9 and 1.125 respectively. For this series find

(a) the value of the common ratio, (3)

(b) the first term, (2)

The cost of Brian's new car was £P. He accepted an interest-free loan of £P, which he agreed to repay by monthly instalments. The first instalment was £120. The instalments were increased by £5 per month so that the second and third instalments were £125 and £130 respectively.

Given that the loan was repaid in n instalments, and that the final instalment was £325,

(a) show that $n = 42$, **(2)**

(b) find the value of P.**(3)**

The curve with equation $y = (2x + 1)(x^2 - k)$, where k is a constant, has a stationary point where $x = 1$.

(a) Determine the value of k. **(4)**

(a) Sketch, for $0 \leq x \leq 360°$, the graph of $y = \sin(x + 30°)$. (2)

(b) Write down the coordinates of the points at which the graph meets the axes. (3)

$f(x) = ax^3 + 3x^2 + bx + 1$, where a and b are constants.

When $f(x)$ is divided by $(x - 1)$ there is a remainder of 5. When $f(x)$ is divided by $(x + 2)$ there is a remainder of -1.

Find the value of a and the value of b.

A circle C1 has equation $x^2 + y^2 - 12x + 4y + 20 = 0$.

(a) Find the coordinates of the centre of C1. **(2)**

(b) Find the radius of C1. **(2)**

The curve C has equation $y = 4x^2 + \frac{5x-1}{x}$.

(a) Find $\frac{dy}{dx}$. **(3)**

(b) Find the x-coordinate of the stationary point of C. **(3)**