

# Core-Maths-C2 - 2010-January

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## Question 1

Find the first 3 terms, in ascending powers of  $x$ , of the binomial expansion of

$$(3 - x)^6$$

and simplify each term.

(4)

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## Question 2

(a) Show that the equation

$$5 \sin x = 1 + 2 \cos^2 x$$

can be written in the form

$$2 \sin^2 x + 5 \sin x - 3 = 0$$

(2)

(b) Solve, for  $0 \leq x < 360^\circ$ ,

$$2 \sin^2 x + 5 \sin x - 3 = 0$$

(4)

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### Question 3

$$f(x) = 2x^3 + ax^2 + bx - 6$$

where  $a$  and  $b$  are constants.

When  $f(x)$  is divided by  $(2x - 1)$  the remainder is  $-5$ .

When  $f(x)$  is divided by  $(x + 2)$  there is no remainder.

(a) Find the value of  $a$  and the value of  $b$ .

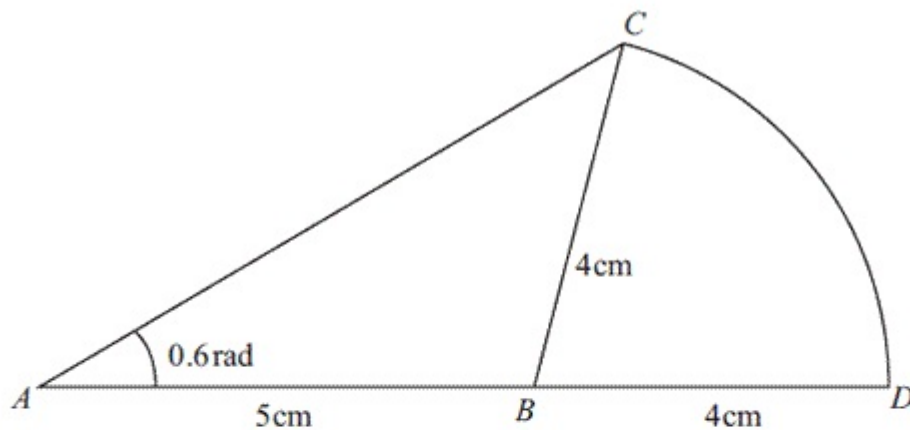
(6)

(b) Factorise  $f(x)$  completely.

(3)

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### Question 4



**Figure 1**

An emblem, as shown in Figure 1, consists of a triangle  $ABC$  joined to a sector  $CBD$  of a circle with radius 4 cm and centre  $B$ . The points  $A$ ,  $B$  and  $D$  lie on a straight line with  $AB = 5$  cm and  $BD = 4$  cm. Angle  $BAC = 0.6$  radians and  $AC$  is the longest side of the triangle  $ABC$ .

(a) Show that angle  $ABC = 1.76$  radians, correct to 3 significant figures.

(4)

(b) Find the area of the emblem.

(3)

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## Question 5

- (a) Find the positive value of  $x$  such that

$$\log_x 64 = 2 \quad (2)$$

- (b) Solve for  $x$

$$\log_2(11 - 6x) = 2 \log_2(x - 1) + 3 \quad (6)$$

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## Question 6

A car was purchased for £18 000 on 1st January.

On 1st January each following year, the value of the car is 80% of its value on 1st January in the previous year.

- (a) Show that the value of the car exactly 3 years after it was purchased is £9216. (1)

The value of the car falls below £1000 for the first time  $n$  years after it was purchased.

- (b) Find the value of  $n$ . (3)

An insurance company has a scheme to cover the maintenance of the car.

The cost is £200 for the first year, and for every following year the cost increases by 12% so that for the 3rd year the cost of the scheme is £250.88

- (c) Find the cost of the scheme for the 5th year, giving your answer to the nearest penny. (2)

- (d) Find the total cost of the insurance scheme for the first 15 years. (3)
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## Question 7

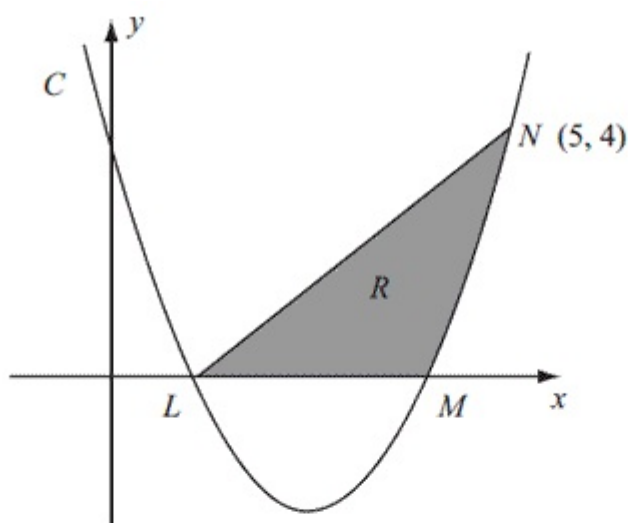


Figure 2

The curve  $C$  has equation  $y = x^2 - 5x + 4$ . It cuts the  $x$ -axis at the points  $L$  and  $M$  as shown in Figure 2.

(a) Find the coordinates of the point  $L$  and the point  $M$ . (2)

(b) Show that the point  $N(5, 4)$  lies on  $C$ . (1)

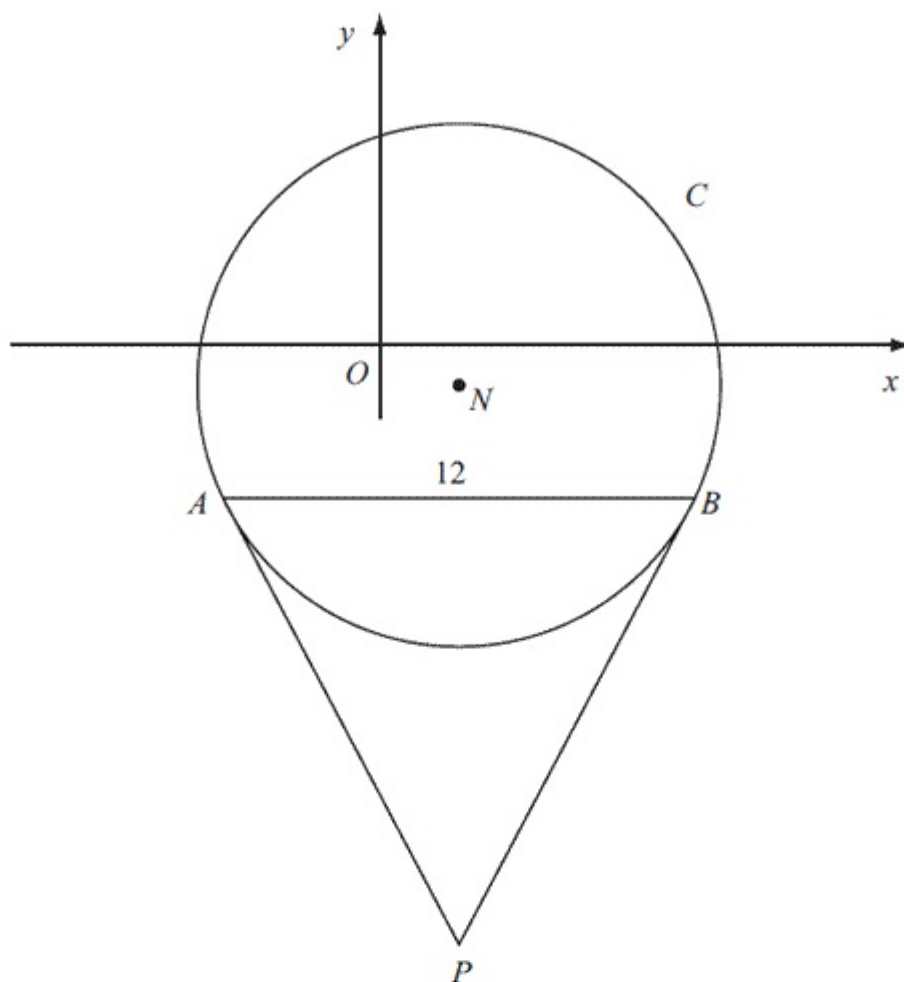
(c) Find  $\int (x^2 - 5x + 4) dx$ . (2)

The finite region  $R$  is bounded by  $LN$ ,  $LM$  and the curve  $C$  as shown in Figure 2.

(d) Use your answer to part (c) to find the exact value of the area of  $R$ . (5)

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## Question 8



**Figure 3**

Figure 3 shows a sketch of the circle  $C$  with centre  $N$  and equation

$$(x - 2)^2 + (y + 1)^2 = \frac{169}{4}$$

- (a) Write down the coordinates of  $N$ . (2)

- (b) Find the radius of  $C$ . (1)

The chord  $AB$  of  $C$  is parallel to the  $x$ -axis, lies below the  $x$ -axis and is of length 12 units as shown in Figure 3.

- (c) Find the coordinates of  $A$  and the coordinates of  $B$ . (5)

- (d) Show that angle  $ANB = 134.8^\circ$ , to the nearest 0.1 of a degree. (2)

The tangents to  $C$  at the points  $A$  and  $B$  meet at the point  $P$ .

- (e) Find the length  $AP$ , giving your answer to 3 significant figures.

### Question 9

The curve  $C$  has equation  $y = 12\sqrt[3]{(x) - x^{\frac{3}{2}}} - 10$ ,  $x > 0$

(a) Use calculus to find the coordinates of the turning point on  $C$ .

(7)

(b) Find  $\frac{d^2y}{dx^2}$ .

(2)

(c) State the nature of the turning point.

(1)

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