

# Core-Maths-C2 - 2009-January

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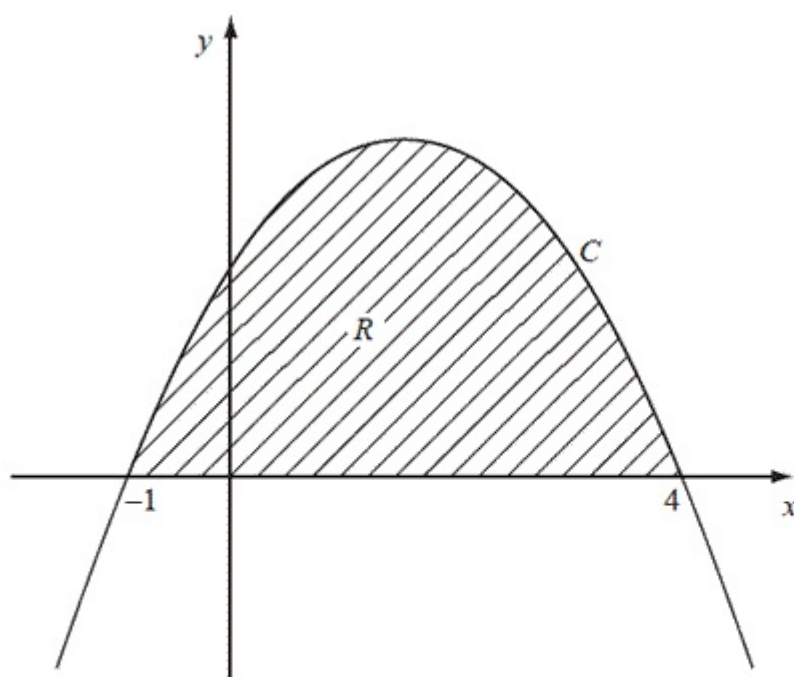
## Question 1

Find the first 3 terms, in ascending powers of  $x$ , of the binomial expansion of  $(3 - 2x)^5$ , giving each term in its simplest form.

(4)

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## Question 2



**Figure 1**

Figure 1 shows part of the curve  $C$  with equation  $y = (1 + x)(4 - x)$ .

The curve intersects the  $x$ -axis at  $x = -1$  and  $x = 4$ . The region  $R$ , shown shaded in Figure 1, is bounded by  $C$  and the  $x$ -axis.

Use calculus to find the exact area of  $R$ .

(5)

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### Question 3

$$y = \sqrt{10x - x^2}.$$

- (a) Complete the table below, giving the values of  $y$  to 2 decimal places.

$x$	1	1.4	1.8	2.2	2.6	3
$y$	3	3.47			4.39	

(2)

- (b) Use the trapezium rule, with all the values of  $y$  from your table, to find an approximation

for the value of  $\int_1^3 \sqrt{10x - x^2} \, dx$ .

(4)

### Question 4

Given that  $0 < x < 4$  and

$$\log_5(4 - x) - 2 \log_5 x = 1,$$

find the value of  $x$ .

(6)

## Question 5

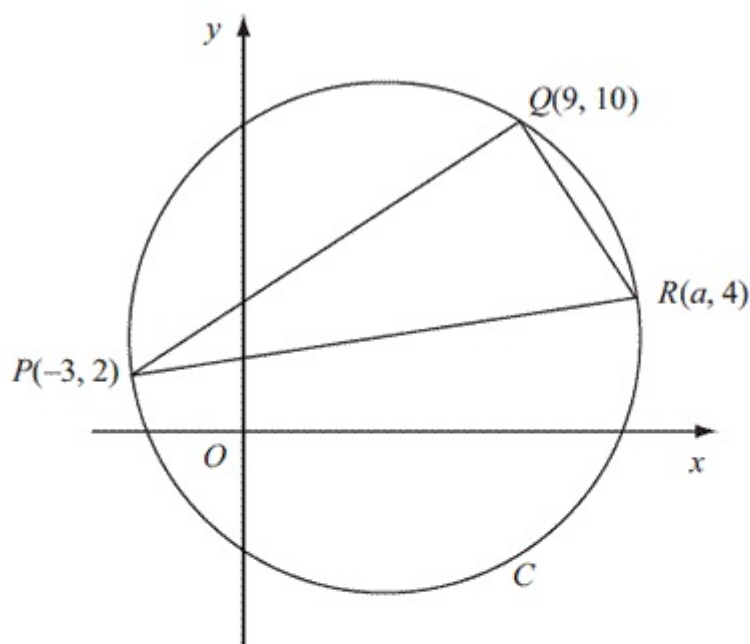


Figure 2

The points  $P(-3, 2)$ ,  $Q(9, 10)$  and  $R(a, 4)$  lie on the circle  $C$ , as shown in Figure 2. Given that  $PR$  is a diameter of  $C$ ,

- (a) show that  $a = 13$ , (3)
- (b) find an equation for  $C$ . (5)
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## Question 6

$$f(x) = x^4 + 5x^3 + ax + b,$$

where  $a$  and  $b$  are constants.

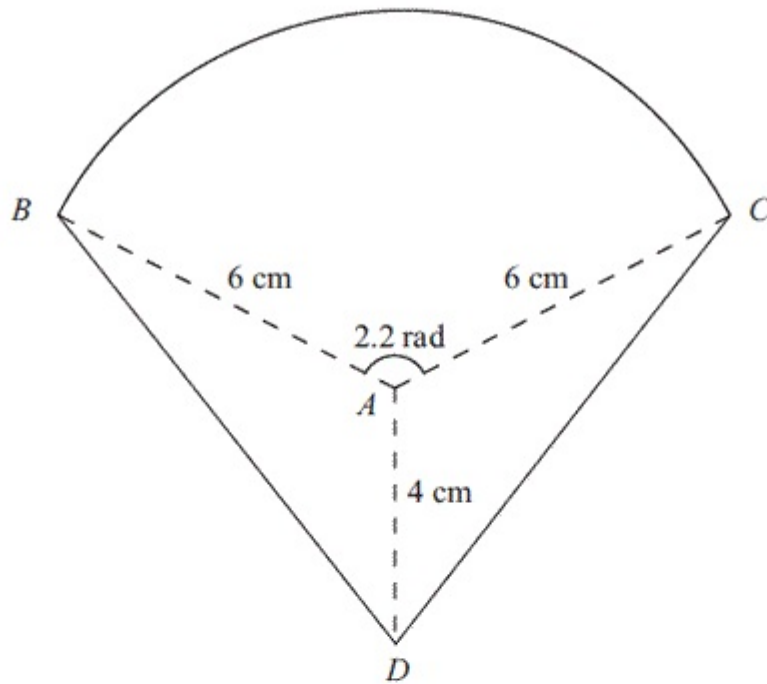
The remainder when  $f(x)$  is divided by  $(x - 2)$  is equal to the remainder when  $f(x)$  is divided by  $(x + 1)$ .

- (a) Find the value of  $a$ . (5)

Given that  $(x + 3)$  is a factor of  $f(x)$ ,

- (b) find the value of  $b$ . (3)
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## Question 7



**Figure 3**

The shape  $BCD$  shown in Figure 3 is a design for a logo.

The straight lines  $DB$  and  $DC$  are equal in length. The curve  $BC$  is an arc of a circle with centre  $A$  and radius 6 cm. The size of  $\angle BAC$  is 2.2 radians and  $AD = 4$  cm.

Find

- (a) the area of the sector  $BAC$ , in  $\text{cm}^2$ , (2)
  - (b) the size of  $\angle DAC$ , in radians to 3 significant figures, (2)
  - (c) the complete area of the logo design, to the nearest  $\text{cm}^2$ . (4)
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## Question 8

- (a) Show that the equation

$$4 \sin^2 x + 9 \cos x - 6 = 0$$

can be written as

$$4 \cos^2 x - 9 \cos x + 2 = 0.$$

(2)

- (b) Hence solve, for  $0 \leq x < 720^\circ$ ,

$$4 \sin^2 x + 9 \cos x - 6 = 0,$$

giving your answers to 1 decimal place.

(6)

## Question 9

The first three terms of a geometric series are  $(k + 4)$ ,  $k$  and  $(2k - 15)$  respectively, where  $k$  is a positive constant.

- (a) Show that  $k^2 - 7k - 60 = 0$ .

(4)

- (b) Hence show that  $k = 12$ .

(2)

- (c) Find the common ratio of this series.

(2)

- (d) Find the sum to infinity of this series.

(2)

## Question 10

A solid right circular cylinder has radius  $r$  cm and height  $h$  cm.

The total surface area of the cylinder is  $800 \text{ cm}^2$ .

(a) Show that the volume,  $V \text{ cm}^3$ , of the cylinder is given by

$$V = 400r - \pi r^3. \quad (4)$$

Given that  $r$  varies,

(b) use calculus to find the maximum value of  $V$ , to the nearest  $\text{cm}^3$ . (6)

(c) Justify that the value of  $V$  you have found is a maximum. (2)

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