

# Core-Maths-C1 - 2007-June

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## Question 1

Simplify  $(3 + \sqrt{5})(3 - \sqrt{5})$ .

(2)

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## Question 2

(a) Find the value of  $8^{\frac{4}{3}}$ .

(2)

(b) Simplify  $\frac{15x^{\frac{4}{3}}}{3x}$ .

(2)

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## Question 3

Given that  $y = 3x^2 + 4\sqrt{x}$ ,  $x > 0$ , find

(a)  $\frac{dy}{dx}$ ,

(2)

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

(2)

(c)  $\int y dx$ .

(3)

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## Question 4

A girl saves money over a period of 200 weeks. She saves 5p in Week 1, 7p in Week 2, 9p in Week 3, and so on until Week 200. Her weekly savings form an arithmetic sequence.

- (a) Find the amount she saves in Week 200.

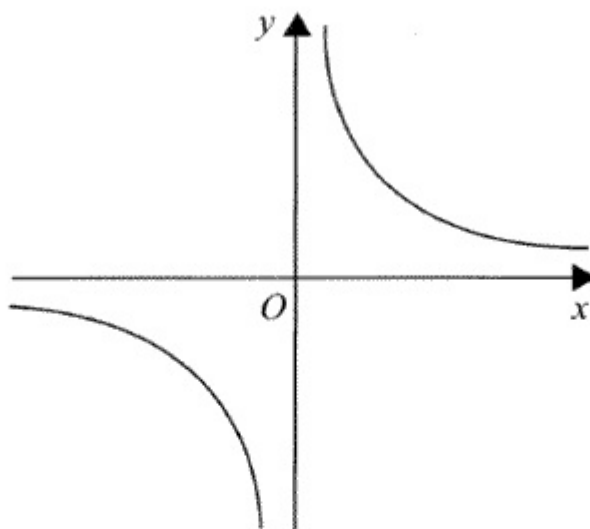
(3)

- (b) Calculate her total savings over the complete 200 week period.

(3)

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## Question 5



**Figure 1**

Figure 1 shows a sketch of the curve with equation  $y = \frac{3}{x}$ ,  $x \neq 0$ .

- (a) On a separate diagram, sketch the curve with equation  $y = \frac{3}{x+2}$ ,  $x \neq -2$ , showing the coordinates of any point at which the curve crosses a coordinate axis.

(3)

- (b) Write down the equations of the asymptotes of the curve in part (a).

(2)

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## Question 6

- (a) By eliminating  $y$  from the equations

$$y = x - 4,$$

$$2x^2 - xy = 8,$$

show that

$$x^2 + 4x - 8 = 0.$$

(2)

- (b) Hence, or otherwise, solve the simultaneous equations

$$y = x - 4,$$

$$2x^2 - xy = 8,$$

giving your answers in the form  $a \pm b\sqrt{3}$ , where  $a$  and  $b$  are integers.

(5)

## Question 7

The equation  $x^2 + kx + (k + 3) = 0$ , where  $k$  is a constant, has different real roots.

- (a) Show that  $k^2 - 4k - 12 > 0$ .

(2)

- (b) Find the set of possible values of  $k$ .

(4)

## Question 8

A sequence  $a_1, a_2, a_3, \dots$  is defined by

$$\begin{aligned}a_1 &= k, \\a_{n+1} &= 3a_n + 5, \quad n \geq 1,\end{aligned}$$

where  $k$  is a positive integer.

(a) Write down an expression for  $a_2$  in terms of  $k$ .

(1)

(b) Show that  $a_3 = 9k + 20$ .

(2)

(c) (i) Find  $\sum_{r=1}^4 a_r$  in terms of  $k$ .

(ii) Show that  $\sum_{r=1}^4 a_r$  is divisible by 10.

(4)

## Question 9

The curve  $C$  with equation  $y = f(x)$  passes through the point  $(5, 65)$ .

Given that  $f'(x) = 6x^2 - 10x - 12$ ,

(a) use integration to find  $f(x)$ .

(4)

(b) Hence show that  $f(x) = x(2x + 3)(x - 4)$ .

(2)

(c) In the space provided on page 17, sketch  $C$ , showing the coordinates of the points where  $C$  crosses the  $x$ -axis.

(3)

## Question 10

The curve  $C$  has equation  $y = x^2(x - 6) + \frac{4}{x}$ ,  $x > 0$ .

The points  $P$  and  $Q$  lie on  $C$  and have  $x$ -coordinates 1 and 2 respectively.

- (a) Show that the length of  $PQ$  is  $\sqrt{170}$ . (4)
  - (b) Show that the tangents to  $C$  at  $P$  and  $Q$  are parallel. (5)
  - (c) Find an equation for the normal to  $C$  at  $P$ , giving your answer in the form  $ax + by + c = 0$ , where  $a$ ,  $b$  and  $c$  are integers. (4)
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## Question 11

The line  $l_1$  has equation  $y = 3x + 2$  and the line  $l_2$  has equation  $3x + 2y - 8 = 0$ .

- (a) Find the gradient of the line  $l_2$ . (2)

The point of intersection of  $l_1$  and  $l_2$  is  $P$ .

- (b) Find the coordinates of  $P$ . (3)

The lines  $l_1$  and  $l_2$  cross the line  $y = 1$  at the points  $A$  and  $B$  respectively.

- (c) Find the area of triangle  $ABP$ . (4)
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