

GCE Examinations  
Advanced Subsidiary

## Core Mathematics C2

Paper E

Time: 1 hour 30 minutes

### *Instructions and Information*

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Candidates may use any calculator EXCEPT those with the facility for symbolic algebra, differentiation and/or integration.

Full marks may be obtained for answers to ALL questions.

Mathematical formulae and statistical tables are available.

This paper has nine questions.

### *Advice to Candidates*

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You must show sufficient working to make your methods clear to an examiner.  
Answers without working may gain no credit.



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1. Evaluate  $\int_2^4 \left(2 - \frac{1}{x^2}\right) dx$ . (4)

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2.  $f(x) = x^3 + 4x^2 - 3x + 7$ .  
Find the set of values of  $x$  for which  $f(x)$  is increasing. (5)

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3. Given that  $p = \log_2 3$  and  $q = \log_2 5$ , find expressions in terms of  $p$  and  $q$  for  
(a)  $\log_2 45$ , (3)  
(b)  $\log_2 0.3$  (3)

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4. The coefficient of  $x^2$  in the binomial expansion of  $(1 + kx)^7$ , where  $k$  is a positive constant, is 525.  
(a) Find the value of  $k$ . (3)  
Using this value of  $k$ ,  
(b) show that the coefficient of  $x^3$  in the expansion is 4375, (2)  
(c) find the first three terms in the expansion in ascending powers of  $x$  of  
 $(2 - x)(1 + kx)^7$ . (3)

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5. (a) Write down the exact value of  $\cos \frac{\pi}{6}$ . (1)

The finite region  $R$  is bounded by the curve  $y = \cos^2 x$ , where  $x$  is measured in radians, the positive coordinate axes and the line  $x = \frac{\pi}{3}$ .

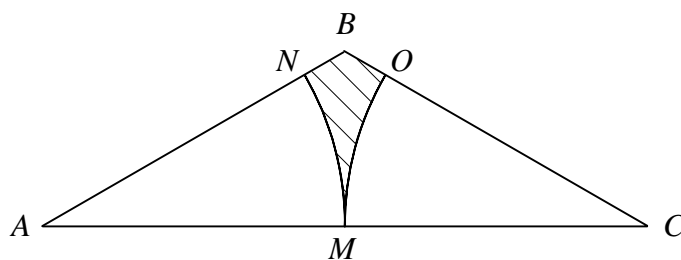
(b) Use the trapezium rule with three equally-spaced ordinates to estimate the area of  $R$ , giving your answer to 3 significant figures. (5)

The finite region  $S$  is bounded by the curve  $y = \sin^2 x$ , where  $x$  is measured in radians, the positive coordinate axes and the line  $x = \frac{\pi}{3}$ .

(c) Using your answer to part (b), find an estimate for the area of  $S$ . (3)

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6.



**Figure 1**

Figure 1 shows triangle  $ABC$  in which  $AC = 8$  cm and  $\angle BAC = \angle BCA = 30^\circ$ .

- (a) Find the area of triangle  $ABC$  in the form  $k\sqrt{3}$ . (5)

The point  $M$  is the mid-point of  $AC$  and the points  $N$  and  $O$  lie on  $AB$  and  $BC$  such that  $MN$  and  $MO$  are arcs of circles with centres  $A$  and  $C$  respectively.

- (b) Show that the area of the shaded region  $BNMO$  is  $\frac{8}{3}(2\sqrt{3} - \pi)$  cm<sup>2</sup>. (4)

7. The circle  $C$  has the equation

$$x^2 + y^2 + 10x - 8y + k = 0,$$

where  $k$  is a constant.

Given that the point with coordinates  $(-6, 5)$  lies on  $C$ ,

- (a) find the value of  $k$ , (2)

- (b) find the coordinates of the centre and the radius of  $C$ . (3)

A straight line which passes through the point  $A(2, 3)$  is a tangent to  $C$  at the point  $B$ .

- (c) Find the length  $AB$  in the form  $k\sqrt{3}$ . (5)

*Turn over*

8. Amy plans to join a savings scheme in which she will pay in £500 at the start of each year.

One scheme that she is considering pays 6% interest on the amount in the account at the end of each year.

For this scheme,

- (a) find the amount of interest paid into the account at the end of the second year, (3)

- (b) show that after interest is paid at the end of the eighth year, the amount in the account will be £5246 to the nearest pound. (4)

Another scheme that she is considering pays 0.5% interest on the amount in the account at the end of each month.

- (c) Find, to the nearest pound, how much more or less will be in the account at the end of the eighth year under this scheme. (5)

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9. The polynomial  $f(x)$  is given by

$$f(x) = x^3 + kx^2 - 7x - 15,$$

where  $k$  is a constant.

When  $f(x)$  is divided by  $(x + 1)$  the remainder is  $r$ .

When  $f(x)$  is divided by  $(x - 3)$  the remainder is  $3r$ .

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

- (b) Find the value of  $r$ . (1)

- (c) Show that  $(x - 5)$  is a factor of  $f(x)$ . (2)

- (d) Show that there is only one real solution to the equation  $f(x) = 0$ . (4)

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**END**