

**Dr Oliver Mathematics**  
**Cambridge O Level Additional Mathematics**  
**2012 June Paper 1 Variant 1: Calculator**  
**2 hours**

The total number of marks available is 80.

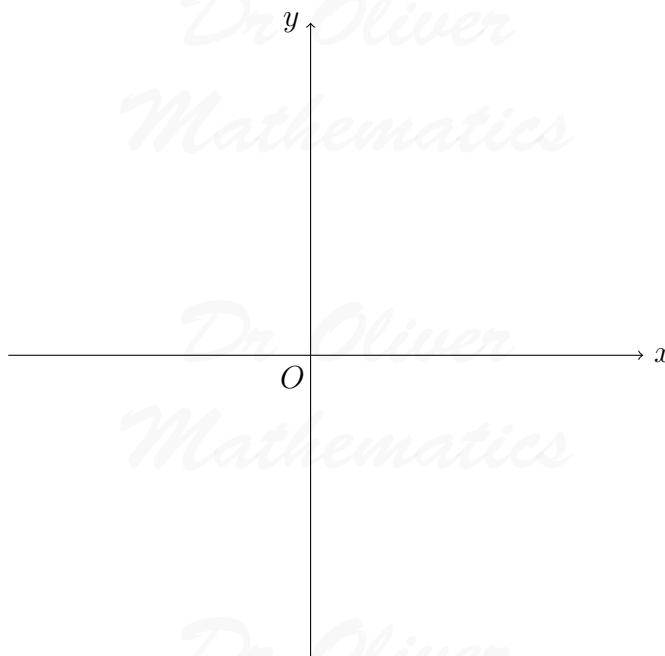
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

You must write down all the stages in your working.

1. (a) Sketch the graph of (2)

$$y = |2x - 5|,$$

showing the coordinates of the points where the graph meets the coordinate axes.



- (b) Solve (2)

$$|2x - 5| = 3.$$

2. The expression (5)

$$2x^3 + ax^2 + bx - 30$$

is divisible by  $(x + 2)$  and leaves a remainder of  $-35$  when divided by  $(2x - 1)$ .

Find the values of the constants  $a$  and  $b$ .

3. Find the set of values of  $k$  for which the line (6)

$$y = 2x + k$$

cuts the curve

$$y = x^2 + kx + 5$$

at two distinct points.

4. Arrangements containing 5 different letters from the word AMPLITUDE are to be made.

Find

- (a) (i) the number of 5-letter arrangements if there are no restrictions, (1)

- (ii) the number of 5-letter arrangements which start with the letter A and end with the letter E. (1)

- (b) Tickets for a concert are given out randomly to a class containing 20 students.

- No student is given more than one ticket.
- There are 15 tickets.

- (i) Find the number of ways in which this can be done. (1)

There are 12 boys and 8 girls in the class.

Find the number of different ways in which

- (ii) 10 boys and 5 girls get tickets, (3)

- (iii) all the boys get tickets. (1)

5. (a) Find the equation of the tangent to the curve (4)

$$y = x^3 + 2x^2 - 3x + 4$$

at the point where the curve crosses the  $y$ -axis.

- (b) Find the coordinates of the point where this tangent meets the curve again. (3)

6. (a) Given that (4)

$$15 \cos^2 \theta + 2 \sin^2 \theta = 7,$$

show that

$$\tan^2 \theta = \frac{8}{5}.$$

- (b) Solve (3)

$$15 \cos^2 \theta + 2 \sin^2 \theta = 7 \text{ for } 0 \leq \theta \leq \pi \text{ radians.}$$

7. The table shows values of variables  $x$  and  $y$ .

|     |     |     |   |     |     |
|-----|-----|-----|---|-----|-----|
| $x$ | 1   | 3   | 6 | 10  | 14  |
| $y$ | 2.5 | 4.5 | 0 | -20 | -56 |

- (a) By plotting a suitable straight line graph, show that  $y$  and  $x$  are related by the equation

$$y = Ax + Bx^2,$$

where  $A$  and  $B$  are constants.

- (b) Use your graph to find the value of  $A$  and of  $B$ . (4)

8. (a) Find the value of  $x$  for which (5)

$$2 \log_{10} x - \log_{10}(5x + 60) = 1.$$

- (b) Solve (4)

$$\log_5 y = 4 \log_y 5.$$

9. Find the values of the positive constants  $p$  and  $q$  such that, in the binomial expansion of (8)

$$(p + qx)^{10},$$

the coefficient of  $x^5$  is 252 and the coefficient of  $x^3$  is 6 times the coefficient of  $x^2$ .

10. Variables  $x$  and  $y$  are such that

$$y = e^{2x} + e^{-2x}.$$

- (a) Find  $\frac{dy}{dx}$ . (2)

- (b) By using the substitution  $u = e^{2x}$ , find the value of  $y$  when  $\frac{dy}{dx} = 3$ . (4)

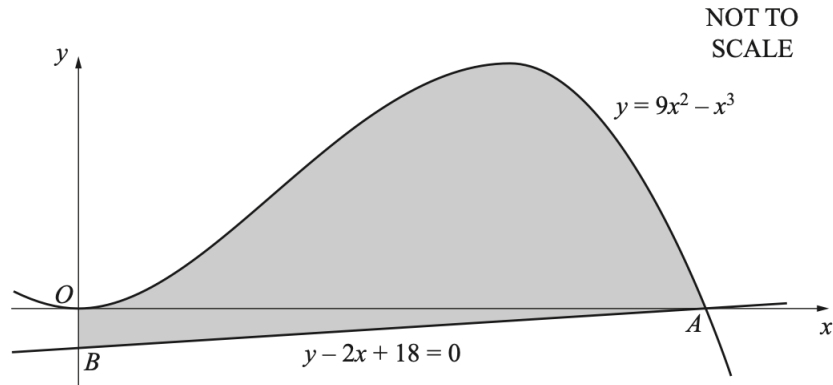
- (c) Given that  $x$  is decreasing at the rate of  $0.5 \text{ units s}^{-1}$ , find the corresponding rate of change of  $y$  when  $x = 1$ . (3)

### **EITHER**

11. The diagram shows part of the curve

$$y = 9x^2 - x^3,$$

which meets the  $x$ -axis at the origin  $O$  and at the point  $A$ .



The line

$$y - 2x + 18 = 0$$

passes through  $A$  and meets the  $y$ -axis at the point  $B$ .

(a) Show that, for  $x \geq 0$ ,

$$9x^2 - x^3 \leq 108.$$

(4)

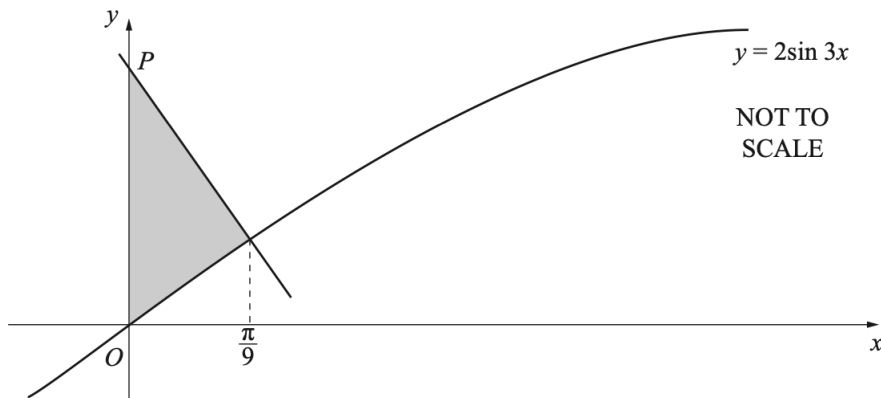
(b) Find the area of the shaded region bounded by the curve, the line  $AB$ , and the  $y$ -axis.

(6)

**OR**

12. The diagram shows part of the curve

$$y = 2 \sin 3x.$$



The normal to the curve

$$y = 2 \sin 3x$$

at the point where  $x = \frac{1}{9}\pi$  meets the  $y$ -axis at the point  $P$ .

- (a) Find the coordinates of  $P$ . (5)
- (b) Find the area of the shaded region bounded by the curve, the normal, and the  $y$ -axis. (5)

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