

Dr Oliver Mathematics
Cambridge O Level Additional Mathematics
2012 November Paper 2 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. Solve the equation

$$|7x + 5| = |3x - 13|. \quad (4)$$

2. The total surface area, $A \text{ cm}^2$, of a solid cylinder with radius $r \text{ cm}$ and height 5 cm is given by

$$A = 2\pi r^2 + 10\pi r.$$

Given that r is increasing at a rate of 0.2 cm s^{-1} , find the rate of increase of A when $r = 6$.

3. Solve the inequality

$$4x(4 - x) > 7. \quad (4)$$

4. (a) Find the coefficient of x^5 in the expansion of
- $$(2 - x)^8. \quad (2)$$

- (b) Find the coefficient of x^5 in the expansion of
- $$(1 + 2x)(2 - x)^8. \quad (3)$$

5. A 4-digit number is formed by using four of the six digits 2, 3, 4, 5, 6, and 8; no digit may be used more than once in any number.

How many different 4-digit numbers can be formed if

- (a) there are no restrictions, (2)

- (b) the number is even and more than 6 000? (3)

6. (a) Given that (2)

$$\frac{2^{x-3}}{8^{2y-3}} = 16^{x-y},$$

show that

$$3x + 2y = 6.$$

- (b) Given also that (4)

$$\frac{5^y}{125^{x-2}} = 25,$$

find the value of x and of y .

7. (a) Find (2)

$$\frac{d}{dx}(\tan 4x).$$

- (b) Hence find (3)

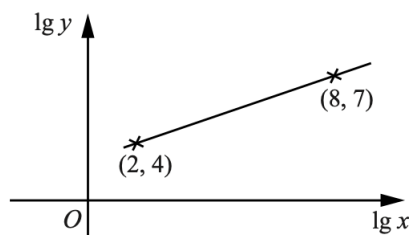
$$\int (1 + \sec^2 4x) dx.$$

- (c) Hence show that (2)

$$\int_{-\frac{1}{16}\pi}^{\frac{1}{16}\pi} (1 + \sec^2 4x) dx = k(\pi + 4),$$

where k is a constant to be found.

8. The variables x and y are related in such a way that when $\log_{10} y$ is plotted against $\log_{10} x$ a straight line graph is obtained as shown in the diagram.



The line passes through the points $(2, 4)$ and $(8, 7)$.

- (a) Express y in terms of x , giving your answer in the form (5)

$$y = ax^b,$$

where a and b are constants.

Another method of drawing a straight line graph for the relationship

$$y = ax^b,$$

found in part (a), involves plotting $\log_{10} x$ on the horizontal axis and $\log_{10}(y^2)$ on the vertical axis.

For this straight line graph what is

- (b) the gradient, (1)
- (c) the intercept on the vertical axis? (1)

9. A plane, whose speed in still air is 420 kmh^{-1} , travels directly from A to B , a distance of 1 000 km.

The bearing of B from A is 230° and there is a wind of 80 kmh^{-1} from the east.

- (a) Find the bearing on which the plane was steered. (4)
- (b) Find the time taken for the journey. (4)

10. The acceleration, $a \text{ ms}^{-2}$, of a particle, $t \text{ s}$ after passing through a fixed point O , is given by

$$a = 4 - 2t, \text{ for } t > 0.$$

The particle, which moves in a straight line, passes through O with a velocity of 12 ms^{-1} .

- (a) Find the value of t when the particle comes to instantaneous rest. (5)
- (b) Find the distance from O of the particle when it comes to instantaneous rest. (3)

11. (a) Solve (3)

$$4 \sin x + 9 \cos x = 0, \text{ for } 0^\circ < x < 360^\circ.$$

- (b) Solve (5)

$$\operatorname{cosec} y - 1 = 12 \sin y, \text{ for } 0^\circ < y < 360^\circ.$$

- (c) Solve (4)

$$3 \sec\left(\frac{1}{3}z\right) = 5, \text{ for } 0 < z < 6\pi \text{ radians.}$$

EITHER

12. The point $A(0, 10)$ lies on the curve for which

$$\frac{dy}{dx} = e^{-\frac{1}{4}x}.$$

The point B , with x -coordinate -4 , also lies on the curve.

- (a) Find, in terms of e , the y -coordinate of B . (5)

The tangents to the curve at the points A and B intersect at the point C .

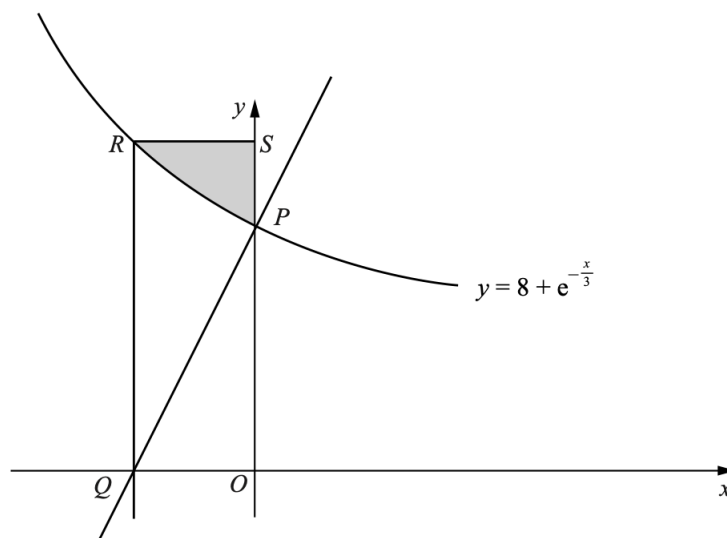
- (b) Find, in terms of e , the x -coordinate of the point C . (5)

OR

13. The diagram shows part of the curve

$$y = 8 + e^{-\frac{1}{3}x}$$

crossing the y -axis at P .



The normal to the curve at P meets the x -axis at Q .

(a) Find the coordinates of Q .

(4)

The line through Q , parallel to the y -axis, meets the curve at R and $OQRS$ is a rectangle.

(b) Find

(6)

$$\int (8 + e^{-\frac{1}{3}x}) \, dx$$

and hence find the area of the shaded region.