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0606/11

October/November 2019

2 hours

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

You are reminded of the need for clear presentation in your answers.

The total number of marks for this paper is 80.

This document consists of **16** printed pages.

Mathematical Formulae**1. ALGEBRA***Quadratic Equation*

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \dots + \binom{n}{r} a^{n-r} b^r + \dots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY*Identities*

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

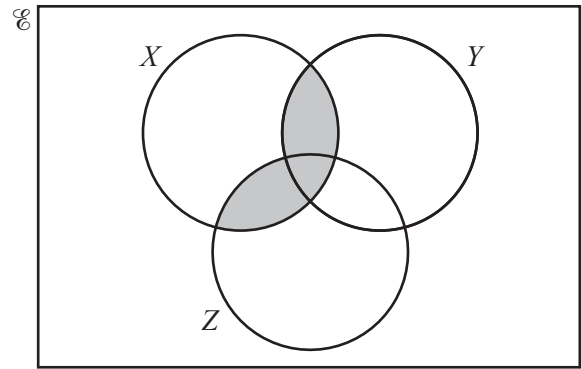
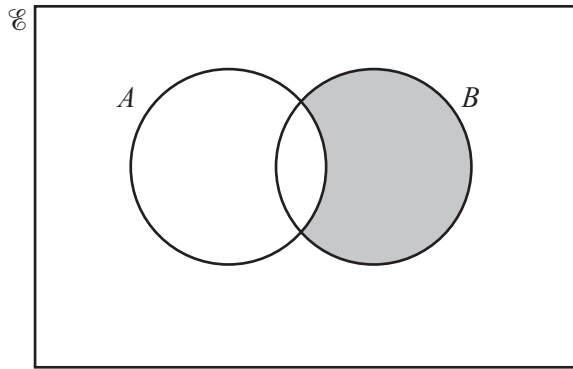
Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

- 1 Using set notation, describe the regions shaded on the Venn diagrams below.



.....

..... [2]

- 2 Find the values of k for which the line $y = kx - 3$ and the curve $y = 2x^2 + 3x + k$ do not intersect. [5]

- 3 Given that $7^x \times 49^y = 1$ and $5^{5x} \times 125^{\frac{2y}{3}} = \frac{1}{25}$, calculate the value of x and of y . [5]

4 It is given that $y = \frac{\ln(4x^2 + 1)}{2x - 3}$.

(i) Find $\frac{dy}{dx}$. [3]

(ii) Find the approximate change in y as x increases from 2 to $2 + h$, where h is small. [2]

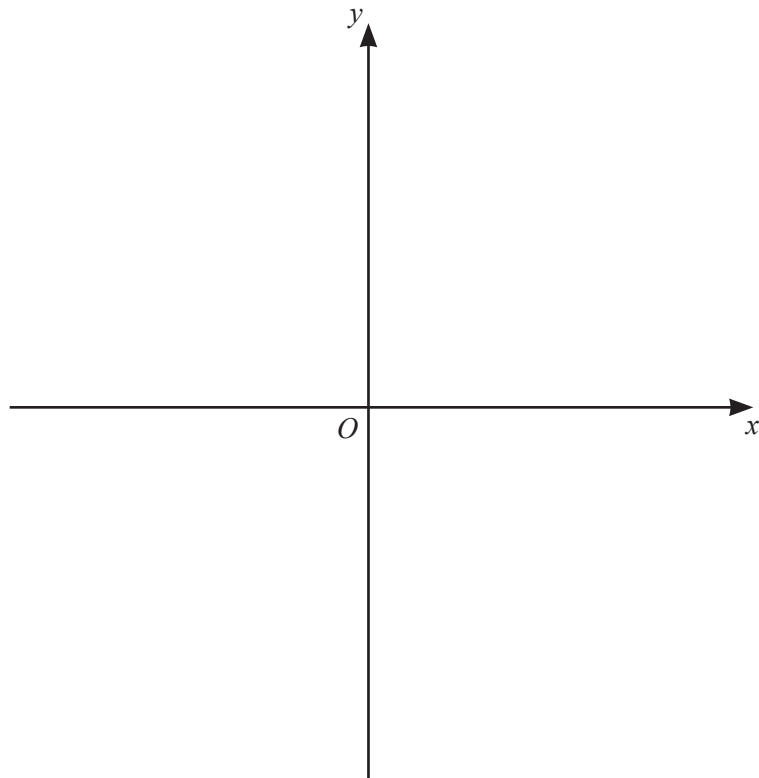
5

$$\begin{aligned} f(x) &= 3e^{2x} + 1 && \text{for } x \in \mathbb{R} \\ g(x) &= x + 1 && \text{for } x \in \mathbb{R} \end{aligned}$$

(i) Write down the range of f and of g . [2]

(ii) Evaluate $fg^2(0)$. [2]

(iii) On the axes below, sketch the graphs of $y = f(x)$ and $y = f^{-1}(x)$, stating the coordinates of the points where the graphs meet the coordinate axes. [3]



- 6 Find the equation of the normal to the curve $y = \sqrt{8x+5}$ at the point where $x = \frac{1}{2}$, giving your answer in the form $ax + by + c = 0$, where a , b and c are integers. [5]

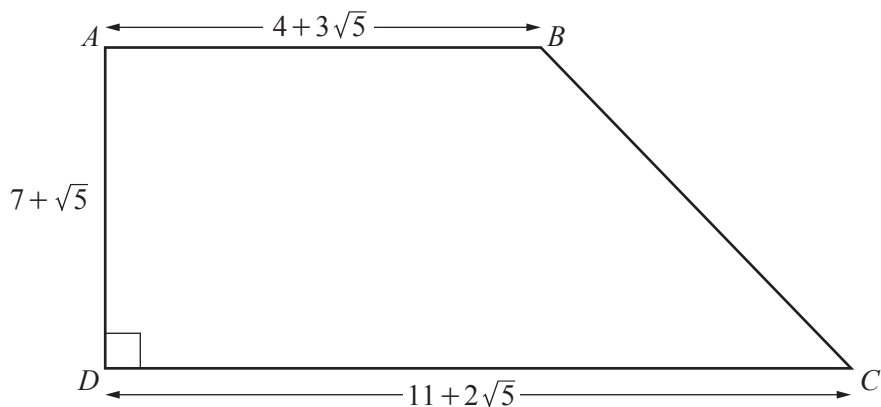
- 7 When $\lg y$ is plotted against x , a straight line graph passing through the points (2.2, 3.6) and (3.4, 6) is obtained.

(i) Given that $y = Ab^x$, find the value of each of the constants A and b . [5]

(ii) Find x when $y = 900$. [2]

8 Do not use a calculator in this question.

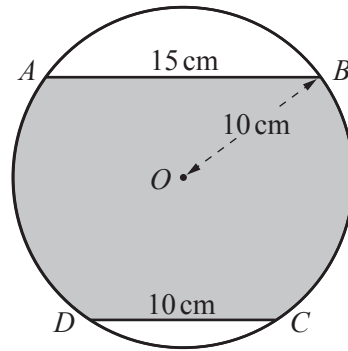
In this question, all lengths are in centimetres.



The diagram shows the trapezium $ABCD$ in which angle ADC is 90° and AB is parallel to DC . It is given that $AB = 4 + 3\sqrt{5}$, $DC = 11 + 2\sqrt{5}$ and $AD = 7 + \sqrt{5}$.

- (i) Find the perimeter of the trapezium, giving your answer in simplest surd form. [3]

- (ii) Find the area of the trapezium, giving your answer in simplest surd form. [3]



The diagram shows a circle with centre O and radius 10 cm. The points A , B , C and D lie on the circle such that the chord $AB = 15$ cm and the chord $CD = 10$ cm. The chord AB is parallel to the chord DC .

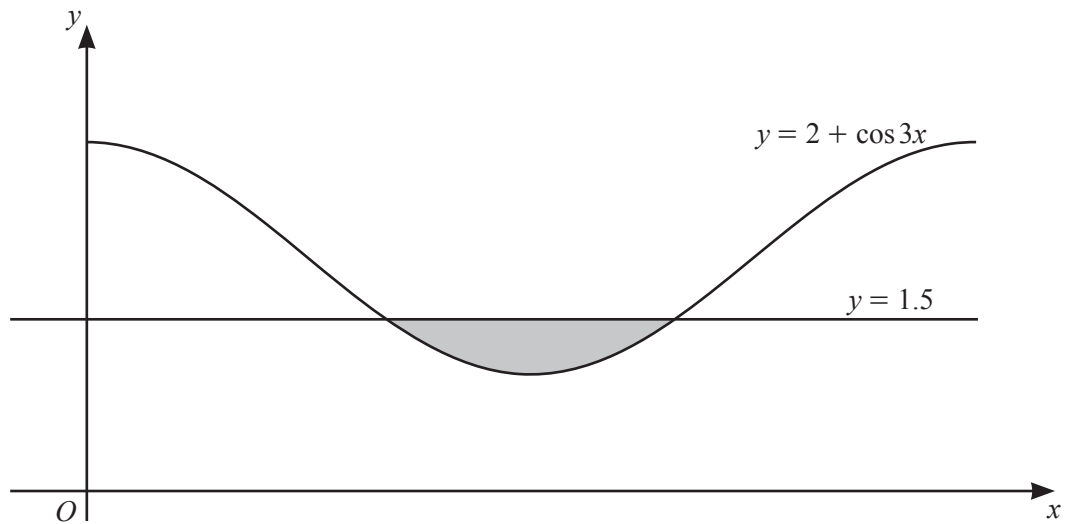
- (i) Show that the angle AOB is 1.70 radians correct to 2 decimal places. [2]

- (ii) Find the perimeter of the shaded region. [4]

(iii) Find the area of the shaded region.

[4]

10



The diagram shows part of the graph of $y = 2 + \cos 3x$ and the straight line $y = 1.5$. Find the exact area of the shaded region bounded by the curve and the straight line. You must show all your working. [9]

Continuation of working space for Question 10

- 11 (a)** Jess wants to arrange 9 different books on a shelf. There are 4 mathematics books, 3 physics books and 2 chemistry books. Find the number of different possible arrangements of the books if

(i) there are no restrictions, [1]

(ii) a chemistry book is at each end of the shelf, [2]

(iii) all the mathematics books are kept together and all the physics books are kept together. [3]

- (b) A quiz team of 6 children is to be chosen from a class of 8 boys and 10 girls. Find the number of ways of choosing the team if

(i) there are no restrictions, [1]

(ii) there are more boys than girls in the team. [4]

Question 12 is printed on the next page.

- 12 A curve is such that $\frac{d^2y}{dx^2} = 2 \sin\left(x + \frac{\pi}{3}\right)$. Given that the curve has a gradient of 5 at the point $\left(\frac{\pi}{3}, \frac{5\pi}{3}\right)$, find the equation of the curve. [8]

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