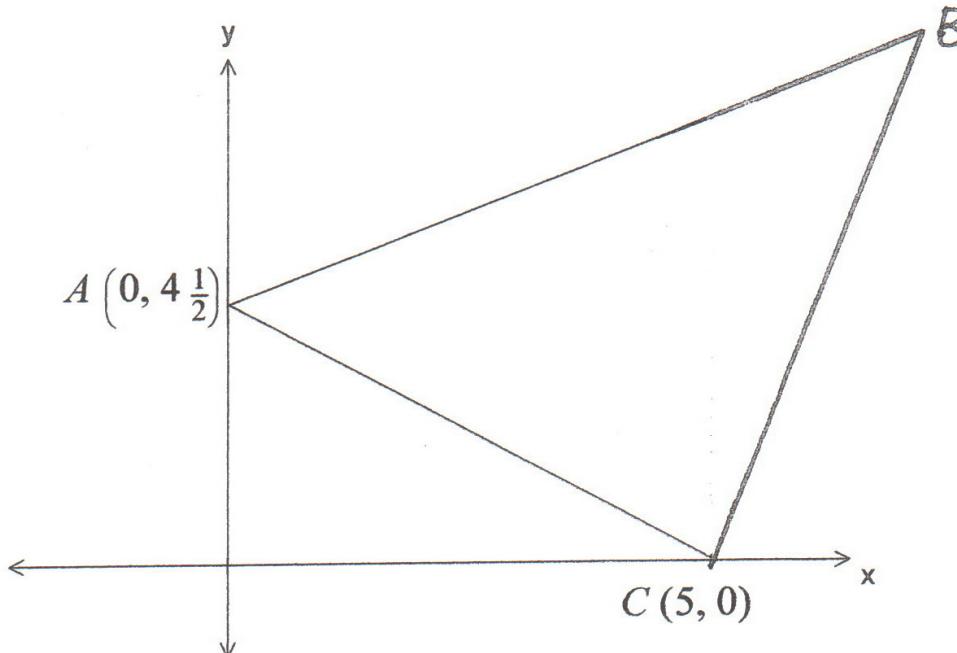


Question 1 (12 Marks)	Use a Separate Sheet of paper	Marks
(a) Express $3.\overline{5}\overline{3}\overline{1}$ as a fraction in simplest form.		2
(b) If $\tan \theta = \frac{7}{8}$ and $\cos \theta < 0$, find the exact value of $\operatorname{cosec} \theta$		2
(c) Solve $ 15 - 4x \leq 3$		2
(d) If $k = \frac{1}{3}m(v^2 - u^2)$ find the value of m when $k = 724$, $v = 14.2$ and $u = 7.4$.		2
(e) Find the period and amplitude for the graph of $3y = \sin\left(2x - \frac{\pi}{4}\right)$.		2
(f) Paint at the local hardware store is sold at a profit of 30% on the cost price. If a drum of paint is sold for \$67.50, find the cost price.		2

Question 2 (12 Marks)**Use a Separate Sheet of paper****Marks**

The lines AB and CB have equations $x - 2y + 9 = 0$ and $4x - y - 20 = 0$ respectively.

- (a) Find the coordinates of the point B . 2
- (b) Show that the equation of the line AC is $9x + 10y - 45 = 0$. 2
- (c) Calculate the distance AC in exact form. 2
- (d) Find the equation of the line perpendicular to BC which passes through A . 2
- (e) Calculate the shortest distance between the point B and the line AC . Hence find the area of the triangle ABC . 2
- (f) State the inequalities that together define the area bounded by the triangle ABC . 2

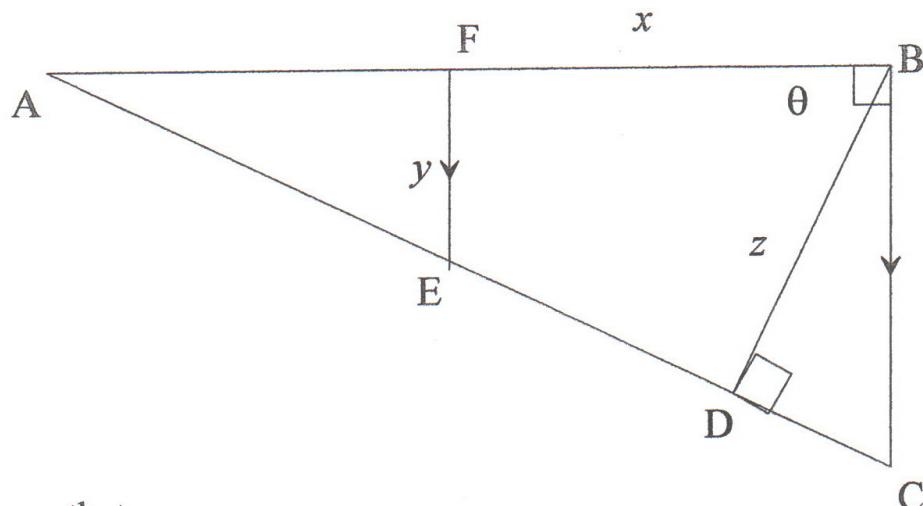
Question 3 (12 Marks)	Use a Separate Sheet of paper	Marks
(a) Differentiate with respect to x .		
i. $3x \sqrt[3]{x}$		2
ii. $\frac{\sin 2x}{e^{2x}}$		2
(b) Find:		
i. $\int \frac{dx}{e^{3x}}$		2
ii. $\int_0^\pi \sec^2 \frac{x}{4} dx$		2
(c) If α and β are the roots of the equation $3x^2 - 4x - 7 = 0$ Find:		
i. $\alpha + \beta$		1
ii. $2\alpha^2 + 2\beta^2$		1
iii. the equation with roots $2\alpha^2$ and $2\beta^2$		2

Question 4 (12 Marks)

Use a Separate Sheet of paper

Marks

- (a) The right triangle ABC is shown below. $BC \parallel FE$, $BD \perp AC$, $\angle FBD = \theta$, $BF = x$, $EF = y$ and $BD = z$.



Prove that:

- i. $\angle FEA = \theta$ 2
- ii. $AF = y \tan \theta$ 1
- iii. $z = (x + y \tan \theta) \cos \theta$ 1
- iv. $z = x \cos \theta + y \sin \theta$ 1

- (b) The federal government distributes \$500 million in order to stimulate the economy. Each recipient spends 80% of the money that he or she receives. In turn, the secondary recipient spends 80% of the money that they receive, and so on. What was the total spending that results from the original \$500 million into the economy? 2

- (c) A ship sails from port A, 60 nautical miles due west, to a port B. It then proceeds a distance of 50 nautical miles on a bearing of 210° to a port C.

- i. Draw a diagram to illustrate the information given. 1
- ii. Find the distance (nearest nautical mile) and bearing of C from A. 4

Question 5 (12 Marks)	Use a Separate Sheet of paper	Marks
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- (a) In a raffle in which 1000 tickets are sold, there is a first prize of \$1000, a second prize of \$500 and a third prize of \$200. The prize winning tickets are drawn consecutively without replacement, with the first ticket winning first prize.

Find the probability that:

- i. a person buying one ticket in the raffle wins:

a. first prize.

1

b. at least \$500

1

c. no prizes.

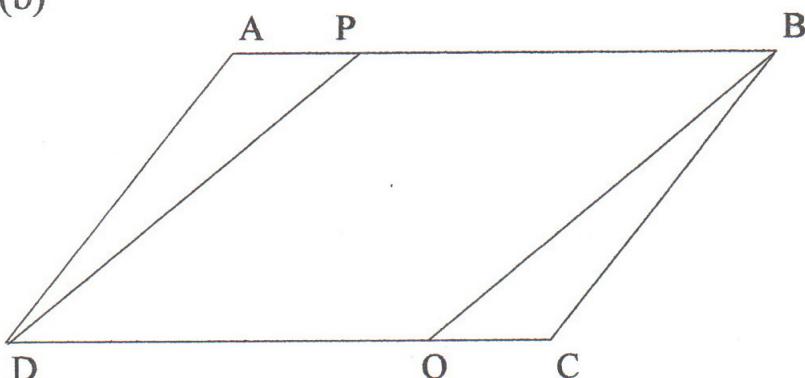
1

- ii. a person buying two tickets in the raffle wins:

a. at least \$500

1

(b)



ABCD is a parallelogram, $BP = DQ$.

Prove $DP = BQ$

- (c) i. Is the series $\log 3 + \log 9 + \log 27 + \dots$ arithmetic or geometric? Give reasons for your answer. 2

- ii Find the sum of the first 10 terms of the series. 1

- (d) Find the radius and centre of the circle with equation 2

$$4x^2 - 4x + 4y^2 + 24y + 21 = 0$$

Question 6 (12 Marks)	Use a Separate Sheet of paper	Marks
(a) A curve has a gradient function with equation $\frac{dy}{dx} = 6(x-1)(x-2)$.		
i. If the curve passes through the point (1, 2), show that the equation of the curve is $y = 2x^3 - 9x^2 + 12x - 3$.		2
ii. Find the coordinates of the stationary points and determine their nature.		2
iii. Find any points of inflection.		2
iv. Graph the function showing all the main features.		2
(b) Show that $\frac{(1 + \tan^2 \theta)\cot \theta}{\operatorname{cosec}^2 \theta} = \tan \theta$		2
(c) Evaluate $\frac{3.24^2 - 2.1^2}{\sqrt{36+2.1}}$ correct to 3 significant figures.		2

Question 7 (12 Marks) Use a Separate Sheet of paper **Marks**

- (a) The parabola $y = x^2$ and the line $y = x + 2$ intersect at points A and B respectively. Find the coordinates of the points A and B. Hence find the area bounded by the parabola and the line. 4

- (b) The minute hand on a clock face is 12 centimetres long.
In 40 minutes

- i. Through what angle does the hand move (in radians)? 1
- ii. How far does the tip of the hand move? 1
- iii. What area does the hand sweep through in this time? 1

- (c) Use Simpson's rule to evaluate $\int_1^{2.5} f(x) dx$, to 1 decimal place 2
using the 7 function values in the table below.

x	1.00	1.25	1.50	1.75	2.00	2.25	2.50
$f(x)$	3.43	2.17	0.38	1.87	2.65	2.31	1.97

- (d) A function is defined by the following features: 3

$$\frac{d^2y}{dx^2} > 0 \text{ for } x < -1 \text{ and } 1 < x < 3.$$

$$\frac{dy}{dx} = 0 \text{ when } x = -3, 1 \text{ and } 5.$$

$$y = 0 \text{ when } x = 1.$$

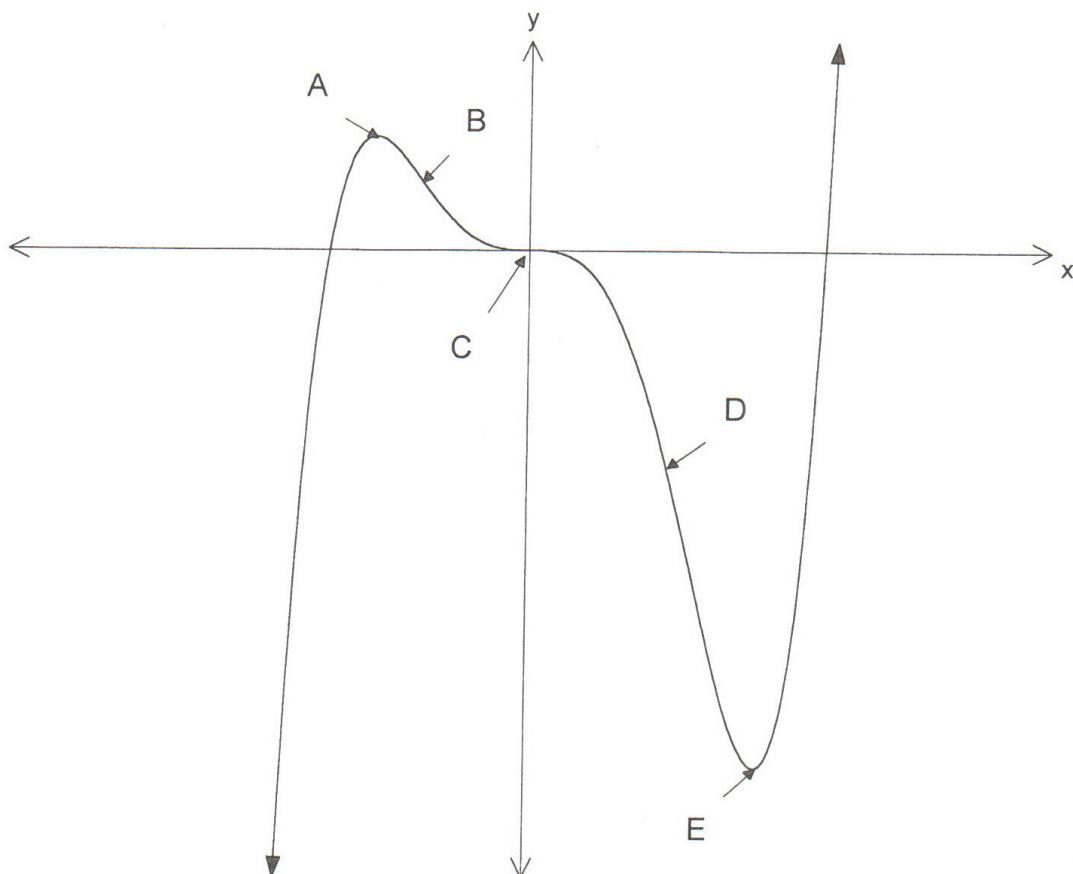
Sketch a possible graph of the function.

Question 8 (12 Marks)

Use a Separate Sheet of paper

Marks

- (a) The graph of the curve $y = f(x)$ is drawn below.



- i. Name the points of inflexion. 1
- ii. When is the graph decreasing? 1
- iii. Sketch the gradient function. 1

- (b) Steve borrows \$15 000 for a new car. He decides to repay the loan plus interest at 6% pa compounded monthly. He repays the loan in monthly installments of \$P.

- i. Show that after three months the amount that Steve owes is $\$[15226.13 - P(3.015025)]$. 2
- ii. After two years of repaying his loan, Steve still owes \$10 000 on the loan. What was the monthly repayment? 3

- (c) Sketch the graph of the parabola $2x = y^2 - 8y + 4$, showing the vertex, focus and the directrix. 4

Question 9 (12 Marks)	Use a Separate Sheet of paper	Marks
(a) A particle moves in a straight line so that its displacement (in m) from a fixed point O at time t seconds is given by $x = 2 \sin 2t$, $0 \leq t \leq 2\pi$.		
Find:		
i. The initial velocity	1	
ii. The acceleration after $\frac{\pi}{12}$ seconds.	1	
iii. When the particle is at rest.	2	
iv. The displacement of the particle when it is at rest.	2	
(b) The area bounded by the curve $y = \sqrt{\frac{2x}{3x^2 - 1}}$ between the lines $x = 1$ and $x = 3$ is rotated about the x -axis. Find the volume of the solid of revolution formed.	3	
(c) The rate at which Carbon Dioxide will be produced when conducting an experiment is given by $\frac{dV}{dt} = \frac{1}{100}(30t - t^2)$ where $V \text{ cm}^3$ is the volume of gas produced after t minutes.		
i. At what rate is the gas being produced 15 minutes after the experiment begins.	1	
ii. How much Carbon Dioxide has been produced during this time?	2	

Question 10 (12 Marks)	Use a Separate Sheet of paper	Marks
(a) An open cylindrical can is made from a sheet of metal with an area of 300cm^2 .		
i. Show that the volume of the can is given by $V = 150r - \frac{1}{2}\pi r^3$.		2
ii. Find the radius of the cylinder that gives the maximum volume and calculate this volume.		4
(b) The population of a certain town grows at a rate proportional to the population. If the population grows from 20 000 to 25 000 in two years, find:		
i. The population of the town, to the nearest hundred, after a further 8 years.		3
ii. Calculate the rate of change at this time.		1
(c) If $\log_a 2 + 2\log_a x - \log_a 6 = \log_a 3$ find the value of x .		2

End of Examination.