

Mathematical Formulae

Compound interest

$$\text{Total amount} = P \left(1 + \frac{r}{100} \right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4 \pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2} a b \sin C$$

$$\text{Arc length} = r \theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2} r^2 \theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

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

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

Statistics

$$\text{Mean} = \frac{\sum f x}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum f x^2}{\sum f} - \left(\frac{\sum f x}{\sum f} \right)^2}$$

Answer **all** the questions.

For
Examiner's
Use

1 (a) Write as a single fraction in its simplest form

(i) $\frac{3}{4u^2-1} - \frac{1}{(1-2u)}$ [2]

(ii) $\frac{9x^2-4}{3x^2-7x-6} \div (3x+2)$. [3]

(b) It is given that $\frac{1}{g} = \frac{1}{u} + \frac{1}{v^2}$. Express v in terms of g and u . [2]

- 2 (a) Zakaria deposited \$9200 in a bank at 1.05% simple interest per annum. After t years, he has \$9683 in the bank. Calculate the value of t .

[2]

- (b) Remy borrowed a sum of money from a bank at the rate of 3.2% per annum, compounded quarterly. At the end of 5 years, he found that he needs to pay the bank a total sum of \$4030. Find the sum of money he borrowed from the bank, giving your answer to the nearest dollar.

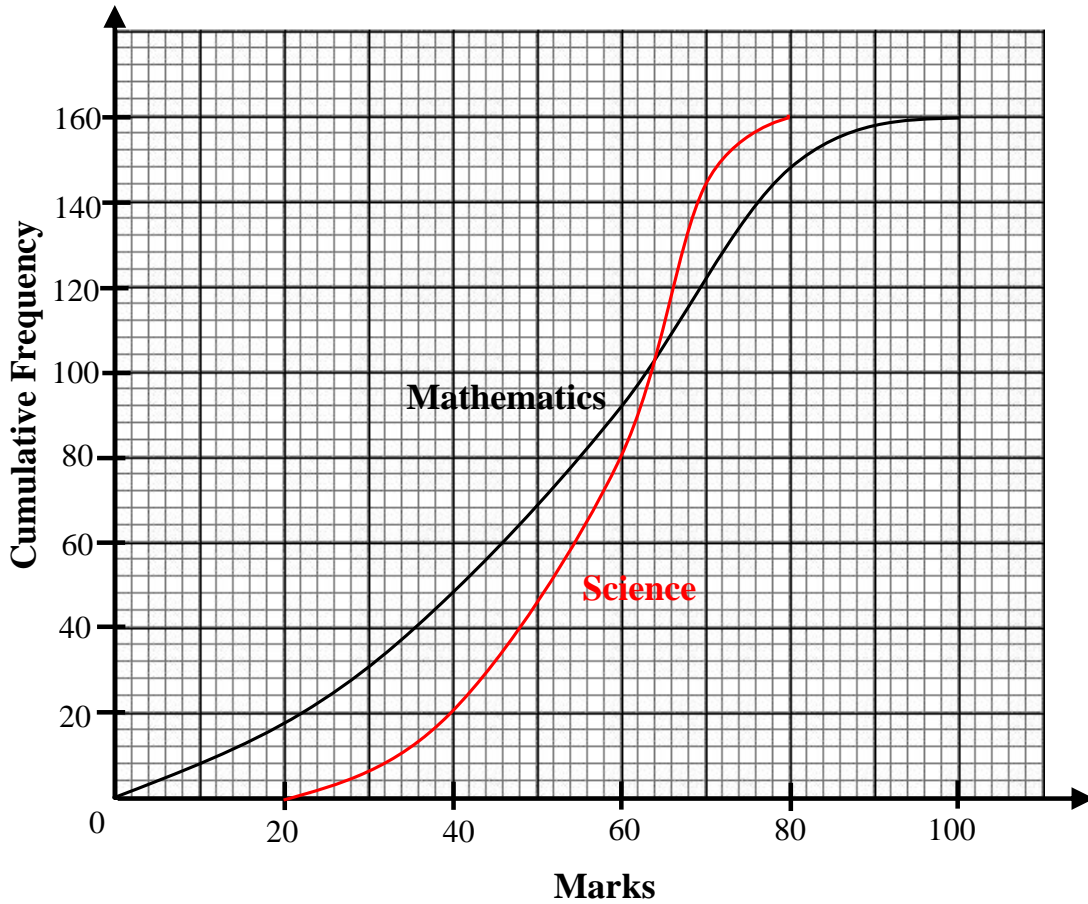
[2]

- (c) Alan bought a washing machine from a dealer at hire purchase. He paid a deposit of \$1760 and took up a loan agreement to repay the outstanding balance. He paid \$86.60 per month for 6 years. Calculate the total amount that he paid for the washing machine.

[2]

*For
Examiner's
Use*

- 3 The diagram below shows the cumulative frequency curves of the results of 160 students in the Mathematics and Science examination.



- (a) Evaluate the number of students who scored more than 60 marks but not greater than 80 marks in the Mathematics examination. Give your answer in fractions [1]
- (b) Given that 45% of the students scored more than x marks in the Mathematics examination, find the value of x . [2]

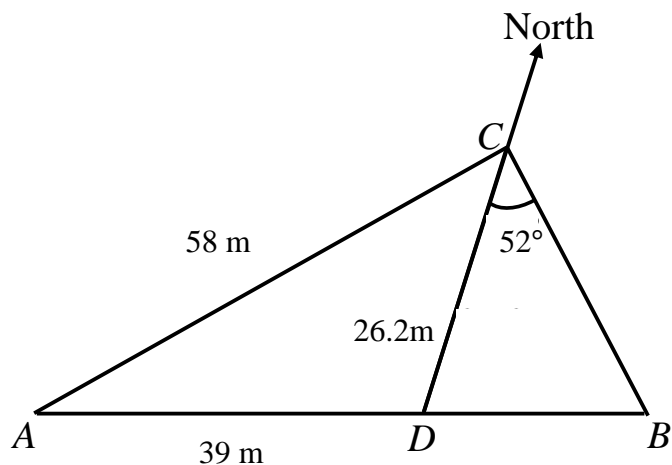
(c) Find the 90th percentile of the distribution of the Science marks.

[1]

(d) A parent commented that the students perform worse in Science than in Mathematics because the highest marks in Mathematics is higher than that in Science. Do you agree? Explain your reasons clearly. [2]

- 4 A, B, C and D are points on a garden. ADB is a straight line
 $AC = 58$ m, $AD = 39$ m, $DC = 26.2$ m and $\angle DCB = 52^\circ$.

For
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Use



(a) Find

(i) $\angle ADC$

[2]

(ii) the bearing of B from C

[2]

(iii) BC ,

[2]

(iv) the area of $\triangle ACD$.

[2]

*For
Examiner's
Use*

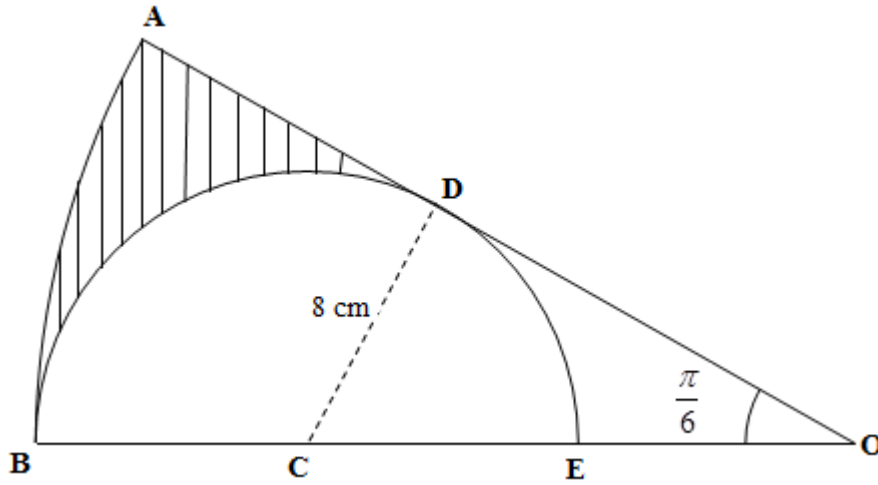
(b) The shortest distance from D to AC.

[2]

(c) A tree of height 6 m was planted at D .
Find the greatest angle of deviation from the top of the tree to a point along AC

[2]

- 5 The diagram the floor area of an indoor playground. The floor area is represented by OAB , which is a sector of a circle with centre O and the radius OA . A semicircle with centre C is drawn inside the sector to mark out the play area such that OA is tangent to the semicircle at D .



- (a) (i) Find the value of $\angle CDO$ in radians. [1]
- (ii) Given that $\angle AOB = \frac{\pi}{6}$ radian, find $\angle BCD$, stating your reasons clearly. [2]
- (b) Find
(i) the length of OC , [2]

(ii) the arc length of AB ,

[3]

*For
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Use*

(iii) the perimeter of the shaded region,

[4]

(iv) the area of the shaded region.

[2]

6 The variables x and y are connected by the equation

For
Examiner's
Use

The table gives some values of x and the corresponding values of y , correct to two decimal place, where $y = \frac{25}{x^2} + 3x - 12$.

x	1.5	2	2.5	3	3.5	4	4.5
y	3.61	0.25	-0.50	-0.22	0.54	p	2.73

(a) Find the value of p . [1]

(b) Using a scale of 2 cm to represent 0.5 unit for horizontal x -axis and 2 cm to represent 1 unit for vertical y -axis, draw the graph $y = \frac{25}{x^2} + 3x - 12$ for $1.5 \leq x \leq 4.5$. [3]

(c) Use your graph to find the value(s) of x when $y = 2$. [1]

(d) Using your graph, explain whether $\frac{25}{x^2} + 3x - 12 < 0$ has any solution. [1]

(e) By drawing a tangent, find the gradient of the curve at $x = 2$.

[2]

*For
Examiner's
Use*

(f) (i) Draw the line $y = -x + 3$ on the graph, state the x -intercept(s) with the curve
 $y = \frac{25}{x^2} + 3x - 12$.

[2]

(ii) Write the equation in terms of x such that it has the same solutions as in (f)(i).

[1]

7 Brenda and Jane were training for the Olympics in a pool where one lap is equivalent to 50 m. Brenda started swimming $3\frac{1}{2}$ minutes later than Jane but they stopped at the same time. Brenda swam at an average speed of k m/s and completed 28 laps. Jane's average speed was 0.2 m/s slower and she completed 30 laps.

(i) Write down an expression, in terms of k , for the time taken by Brenda to complete 28 laps. [1]

(ii) Write down an equation in x to represent the information given and show that it reduces to $10k^2 - 7k - 14 = 0$. [3]

(iii) Solve the equation $10k^2 - 7k - 14 = 0$., giving your answers correct to 2 decimal places. [3]

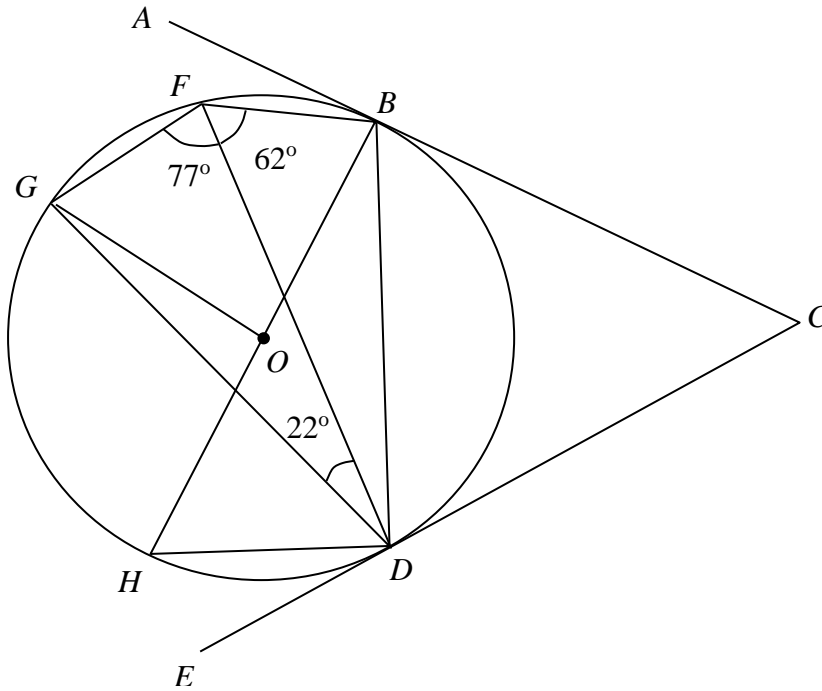
(iv) Find the average of the times taken by Brenda and Jane to swim one lap

[3]

*For
Examiner's
Use*

8 The diagram below is not drawn to scale.

For
Examiner's
Use



(a) In the diagram, BOH is the diameter of the circle with centre O . ABC and EDC are tangents to the circle at B and D respectively. Angle $FDG = 22^\circ$, angle $BFD = 62^\circ$ and angle $GFD = 77^\circ$. Stating your reasons clearly, find

(i) angle FDB , [1]

(ii) angle GOB , [2]

(iii) angle HBD ,

[2]

*For
Examiner's
Use*

(iv) angle BCD .

[2]

- 9 (a) A hawker stall offers three types of bento sets, A, B and C, on Monday, Wednesday and Friday. The numbers of each bento set sold on each of these days in a particular week are shown in the following table.

	Set A	Set B	Set C
Monday	14	9	11
Wednesday	11	14	10
Friday	8	10	10

- (i) The information in the table can be represented by a 3×3 matrix **D**.
Write down the matrix **D**. [1]
- (ii) The prices of Set A, B and C are \$1.50, \$1 and \$2 respectively.
Write down a 3×1 matrix **E** to represent this information. [1]
- (iii) Given that the matrix $\mathbf{F} = \mathbf{DE}$, find **F**.
Explain what is represented by the elements of matrix **F**. [2]

- (iv) The stall earns a profit of \$0.70, \$0.50 and \$1.10 per set A, B and C sold respectively. Write down a matrix \mathbf{X} to represent this information and such that the matrix \mathbf{DX} exists.

[1]

- (v) Hence, **by using matrix multiplication**, find the total amount of profit earned for the week.

[2]

(b) Given that $\begin{pmatrix} 5 & -3 \\ -4 & 0 \end{pmatrix} \begin{pmatrix} -1 \\ 2y \end{pmatrix} = \begin{pmatrix} x \\ -3x-8 \end{pmatrix}$, find the values of x and y . [2]

*For
Examiner's
Use*

10 (a) **A** is the point $(-1, 4)$. **B** is the point $(3, 1)$.

(i) Write down the column vector \overrightarrow{AB} .

[1]

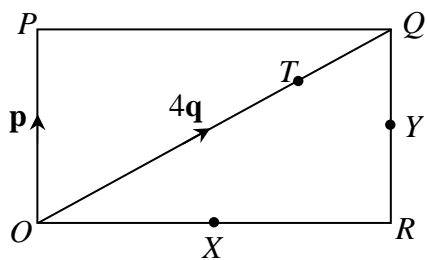
(ii) Find $|\overrightarrow{AB}|$.

[2]

(iii) **C** is the point such that $\overrightarrow{AC} = 3\overrightarrow{AB}$. Find the coordinates of **C**.

[2]

(b)



$OPQR$ is a rectangle.

$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = 4\mathbf{q}$.

X is the mid-point of OR and Y is the mid-point of QR .

T is the point on OQ such that $OT : TQ = 3 : 1$.

(i) Express each of the following, as simply as possible, in terms of \mathbf{p} and /or \mathbf{q} ,

(a) \overrightarrow{PQ} , [1]

(b) \overrightarrow{XY} , [1]

(c) \overrightarrow{TQ} , [1]

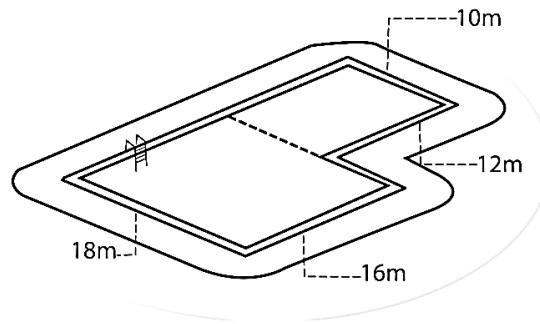
(d) \overrightarrow{XT} .

[1]

(ii) What type of quadrilateral is $XYQT$? Justify your answer using vectors.

[2]

- 11 Springdale Community Club has a swimming that can be divided into 2 rectangular shapes, measuring 18 m by 16 m and 12 m by 10 m respectively as shown in the drawing below.



The following information is also known about this swimming pool

Opening hours:
Mon: 1430 - 2130
Tue – Sun: 0800 - 2100

Weekly maintenance
Mon : Half day (0800 to 1430pm)

Entrance fees		
	Weekday	Weekend
Adult	\$1.50	\$2
Child	\$0.80	\$1

Maintenance cost:

Per Lifeguard: \$5 per hour

Per Maintenance crew: \$20 per hour

Water bill: \$700 per week

2 lifeguards are required to be on duty during the opening hours of the pools.

2 Maintenance crew are required for the Monday maintenance from 0800 to 1400.

(a) Use the information on page 23

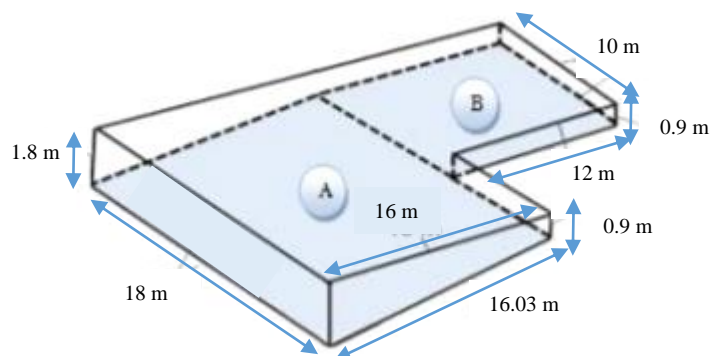
Suppose there are 150 people who use the pool on weekdays and 300 people who use the pool on weekends, out of which 20% are children.

Justify if the swimming pool would generate a profit.

[6]

The diagram below shows a 3 dimensional view of the pool.

*For
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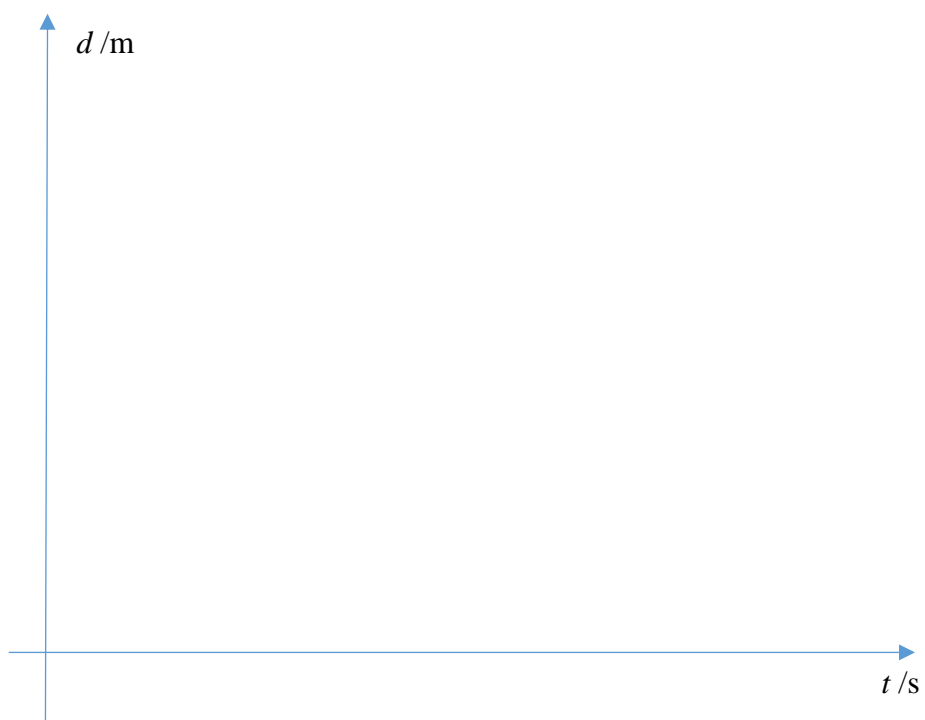
- (b) Assuming the pool is filled at a constant rate of $0.3 \text{ m}^3/\text{s}$, calculate the amount of time it would take to fill the pool, leaving your answer in minutes and seconds.

[3]

- (c) Sketch the graph showing how the depth of the pool varies as the pool is being filled up.

[2]

*For
Examiner's
Use*



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