Name	Index Number	Class

WOODGROVE SECONDARY SCHOOL

A COMMUNITY OF FUTURE-READY LEARNERS AND THOUGHTFUL LEADERS

O-LEVEL PRELIMINARY EXAMINATION 2024

LEVEL & STREAM : SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC

SUBJECT (CODE) : MATHEMATICS (4052)

PAPER : 01

DATE (DAY) : 27 AUGUST 2024 (TUESDAY)

DURATION : 2 HOURS 15 MINUTES

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.

The number of marks in given in brackets [ ] at the end of each question or part question.

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The total number of marks for this paper is 90.

The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer correct to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value of 3.142.

DO NOT TURN OVER THE QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

Student's Signature		**Parent's Signature**	
Date		**Date**	

90

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Mathematical Formulae

Compound Interest

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

Mensuration

Curved surface area of a cone = πrl

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

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

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

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

Arc length = $r\theta$, where θ 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

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$$

$$\text{Standard Deviation} = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$$

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Answer **all** the questions.

1 **(a)** Calculate $\dfrac{-11+\sqrt{(-11)^2-\dfrac{20}{11}}}{8\times 0.6}$.

Write your answer correct to 4 significant figures.

Answer ..... [1]

(b) Write your answer to **part (a)** in standard form.

Answer ..... [1]

2 Expand and simplify $(2x+5)(3+4x)$.

Answer ..... [2]

3 Solve

(a) $3-4x=21$.

Answer ..... [1]

(b) $2x<3x+1\leq 13$,

Answer ..... [2]

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4 **(a)** Express 4312 as a product of its prime factors.

Answer ..... [1]

(b) Given $588 = 2^2 \times 3 \times 7^2$.

Find

(i) The largest integer which is a factor of both 588 and 4312.

Answer ..... [1]

(ii) The smallest integer which is the multiple of both 588 and 4312.

Answer ..... [1]

(iii) The smallest integer value of m such that $4312m$ is a perfect square.

Answer ..... [1]

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5 Given that the coordinates of point A is $(-2,11)$ and point B is $(5,-11)$.

Find

(a) length AB,

Answer ..... [2]

(b) equation of the straight-line AB.

Answer ..... [3]

6 Simplify $\dfrac{9x^2-4}{12x^2-x-6}$.

Answer ..... [3]

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7 Solve $\frac{2}{x+1}-3=\frac{1}{2x-5}$.

Answer ..... [4]

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8 The table below shows a multiple-choice test Sam and Roger took.

	Correct	No attempt	Incorrect
Sam	14	5	1
Roger	15	0	5

(a) Represent this information in a 2×3 matrix, **S**.

Answer $\mathbf{S}=\begin{pmatrix} & & \\ & & \end{pmatrix}$ [1]

(b) The marks are awarded as follow:

Correct = 2 marks
No attempt = 0 mark
Incorrect = -1 mark

Represent the information in a 3×1 matrix, **T**.

Evaluate **ST**

Answer $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(c) Explain what your answer to **(b)** represents.

Answer .....
.....
.....
..... [1]

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9 Factorise completely.

(a) $abc-3c-6+2ab$

Answer ..... [2]

(b) $80x^4-5$

Answer ..... [3]

10 Ken divides his monthly salary into daily expenses, spending and saving in the ratio 3:4:5 respectively. Later he decides to spend $1200 more daily the new ratio become 9:8:7. Calculate his monthly salary.

Answer ..... [3]

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11 John conducted a survey on the average time spent reading per week. This survey was carried out outside Woodlands Regional Library. The table below represents the survey results.

Time spends (t) in hours	$0 \le t < 2$	$2 \le t < 4$	$4 \le t < 6$	$6 \le t < 8$	$8 \le t < 10$	$10 \le t < 12$
Frequency	3	8	9	15	3	2

(a) Calculate the percentage of people spend between 6 to 8 hours per week in reading.

Answer .....% [1]

(b) Calculate the average time spend in reading.

Answer ..... hours [1]

(c) John concludes that the result in **part (b)** is the average of time spent in reading by a Singaporean. Do you agree, give a reason.

Answer .....

.....

.....

.....

..... [2]

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12 The expression $x^2 - 4x + 7$ can be written in the form of $(x-a)^2 + b$

(a) Find the value of a and b.

Answer a= ..... [1]

b= ..... [1]

(b) Explain why the expression gives a minimum value.

Answer

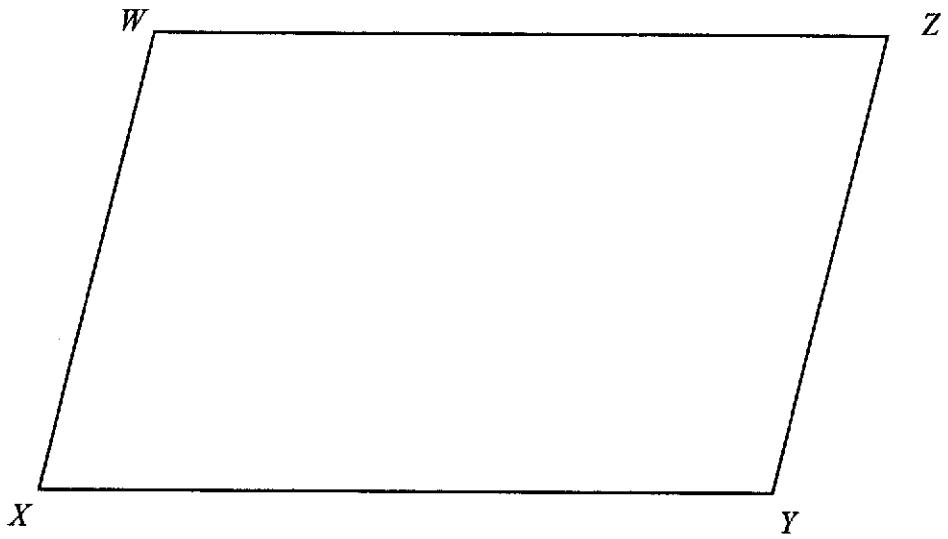
[2]

(c) Write down the minimum value.

Answer ..... [1]

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13 The diagram shows a quadrilateral *WXYZ*.



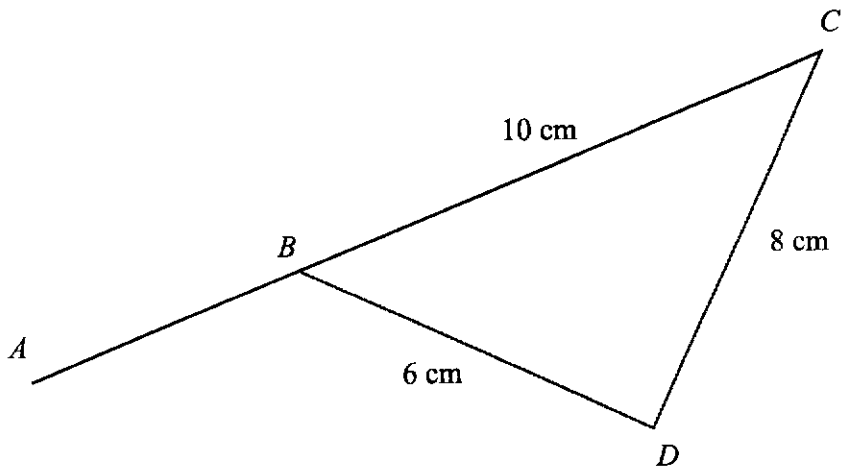
(a) Construct the perpendicular bisector of *XY*. [1]

(b) Construct the bisector of angle *WXY*. [1]

(c) Point *A* in the quadrilateral is equidistant from *X* and *Y* **and** is closer to the line *WX* then to line *XY*.
Mark and label a possible location for point *A* in the diagram above. [1]

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14 In the diagram ABC is a straight line, $BC = 10$ cm, $CD = 8$ cm and $BD = 6$ cm.



(a) Explain why a circle that passes through B, C and D can be drawn in the above diagram.
Give reasons for each step of your working.

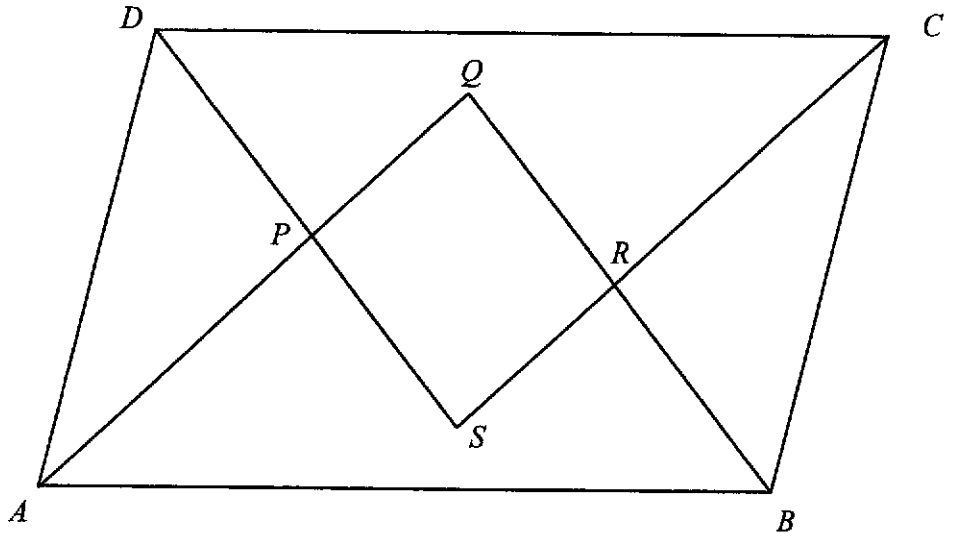
Answer .....
.....
.....
.....
..... [3]

(b) Hence find the exact value of cos ABD.

Answer ..... [1]

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15 The diagram shows a parallelogram $ABCD$. APQ, BRQ, CRS and DPS are straight lines which bisect angles A, B, C and D respectively.



(a) Show that angle PAD = angle RCB. [2]

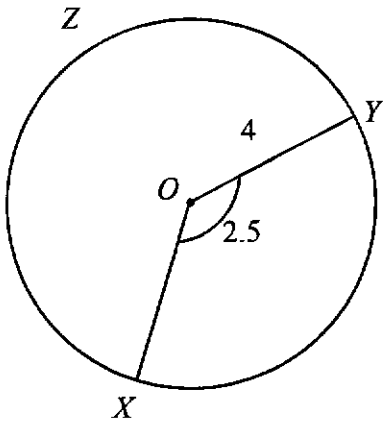
Answer:

(b) Prove that triangles ADP and CBR are congruent. [3]

Answer:

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16 X, Y and Z lie on a circle with centre O and radius 4 cm.
Angle $XOY = 2.5$ radians.



(a) Find the area of minor sector XOY.

Answer .....cm^2 [1]

(b) **(i)** Write down, in term of π, for reflex angle XOY.

Answer ..... [1]

(ii) Find the length of the arc XZY, in term of π.

Answer .....cm [1]

(iii) The major sector $XZYO$ is used to make a cone.
Calculate the base radius of the cone.

Answer .....cm [2]

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17 **(a)** Simplify.

(i) $\frac{a^3}{3a^2} \times 27a^6$

Answer ..... [2]

(ii) $\sqrt{16x^{\frac{4}{3}}}$

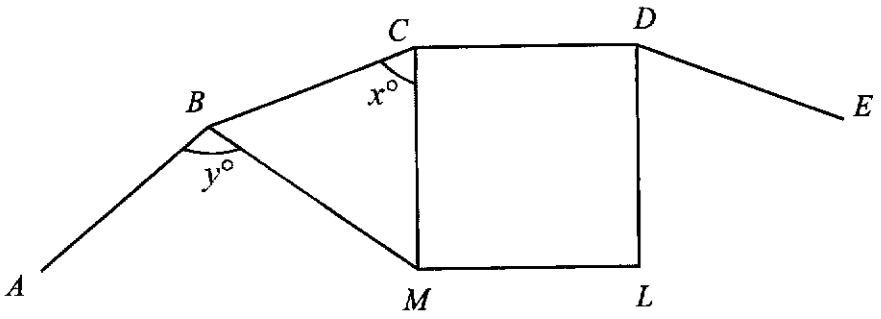
Answer ..... [2]

(b) $\frac{49^{2a}}{7^b} = 343^{4c}$. Find an expression for b in terms of a and c.

Answer ..... [3]

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18 *ABCDE* is part of a regular polygon which has an exterior angle of 20°. *CDLM* is a square.



Find

(a) the value of x,

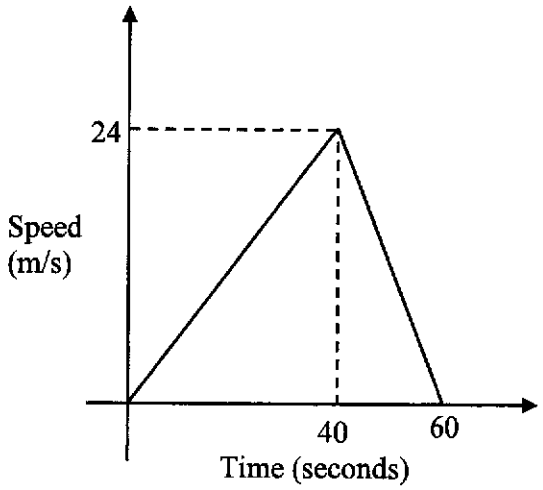
Answer ..... [2]

(b) the value of y.

Answer ..... [2]

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19 The diagram below shows the speed-time graph of a car's journey.



For this journey, calculate

(a) the acceleration during the first 40 seconds,

Answer .....m/s^2 [1]

(a) The total distance travelled.

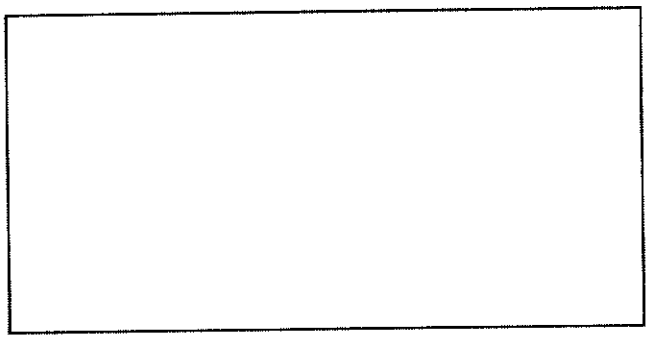
Answer .....m [1]

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20 $\xi = \{ x : x \text{ is an integer and } -3 \leq x < 7 \}$
$P = \{ x : -3 < x < 3 \}$
$Q = \{ x : 0 < x \leq 3 \}$

(a) Draw a Venn diagram below to illustrate this information. [1]

ξ



(b) List the elements in

(i) P',

Answer ..... [1]

(ii) $P \cap Q$.

Answer ..... [1]

(c) Write down $\mathrm{n}(P' \cup Q)$

Answer ..... [1]

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21 The first four terms in a sequence of numbers, $x_1, x_2, x_3, x_4, \ldots$ are given below.

$$x_1=2(0)+1=1$$
$$x_2=2(1)+3=5$$
$$x_3=2(2)+5=9$$
$$x_4=2(3)+7=13$$

(a) Write down an expression for x_5.

Answer ..... [1]

(b) Find an expression, in term of n, for the n^{th} term, x_n, of the sequence.

Answer ..... [2]

(c) Evaluate x_{20}

Answer ..... [1]

(d) Explain why 203 is not a term of this sequence.

Answer .....
.....
.....
.....
..... [2]

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22 A survey was carried out to find out the number of emails received in a week by each of a group of students.

The table below represents the result of the survey.

Number of emails (n)	Frequency
$0 \leq n < 10$	8
$10 \leq n < 20$	13
$20 \leq n < 30$	25
$30 \leq n < 40$	30
$40 \leq n < 50$	18
$50 \leq n < 60$	6

(a) Find the probability that two students, chosen in random, both received at least 40 emails.

Answer ..... [2]

(b) Which interval contain the median number of emails received by the students.

Answer ..... [1]

(c) Calculate an estimate of the mean number of emails received by the students.

Answer ..... [1]

(d) Calculate an estimate of the standard deviation.

Answer ..... [2]

END OF PAPER 1

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Name	Index Number	Class

WOODGROVE SECONDARY SCHOOL

A COMMUNITY OF FUTURE-READY LEARNERS AND THOUGHTFUL LEADERS

O LEVEL PRELIMINARY EXAMINATION 2024

LEVEL & STREAM	: SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC
SUBJECT (CODE)	: MATHEMATICS (4052)
PAPER	: 02
DATE (DAY)	: 22 AUGUST 2024 (THURSDAY)
DURATION	: 2 HOURS 15 MINUTES

READ THESE INSTRUCTIONS FIRST

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You may use a HB pencil for any diagrams, graphs, tables or rough working.
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Student's Signature		**Parent's Signature**	
Date		**Date**	

90

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Mathematical Formulae

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$$

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

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Answer **all** the questions.

1 (a)

$$b = \frac{a}{a-1} + \frac{2}{c}$$

(i) Find the value of b when $a = 3$ and $c = 4$.

Answer $b =$ ..... [1]

(ii) Rearrange the formula to make a the subject.

Answer ..... [3]

(b) Solve these simultaneous equations.

$$4x - y = -11$$
$$5x + 3y = -1$$

Answer $x =$ .....

$y =$ ..... [3]

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(c) Solve the equation $\frac{x}{3x-1}-\frac{5}{2x+3}=1$.

Give your solutions correct to three decimal places.

Answer $x =$ ..... or ..... [4]

2 (a) Timmy wants to invest a sum of money in one of the following investment plans.

Plan *A*	Pays 2% simple interest per year
Plan *B*	Pays 2% compound interest per year

Which investment plan is the better choice for Timmy?
Explain your answer.

Answer : .....

.....

..... [1]

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(b) Mary deposits \$8000 in a savings account at a simple interest rate of 3.5% per year. Calculate the total value of her savings at the end of 12 years.

Answer \$ ..... [2]

(c) Peter invested \$50 000 in an investment plan from 2010 to 2024.
The value of his investment increased by r% at the end of every year.
At the end of 2024, the total value of Peter's investment is \$65 320.

Calculate the value of r.

Answer $r =$ ..... [3]

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(d) The current exchange rate between Singapore dollars (SGD) and Thailand baht (THB) is given as SGD 1 = THB 27.16.

Susan bought a bag while shopping in Thailand. The original price of the bag was THB 56 000 and Susan bought it at a 15% discount.

Susan paid for the bag using her credit card which charged her an additional 2% fee for overseas transaction.

Calculate the total amount, including credit card fee, that Susan had to pay in Singapore dollars (SGD). Correct your answer to the nearest cent.

Answer $ ..... [3]

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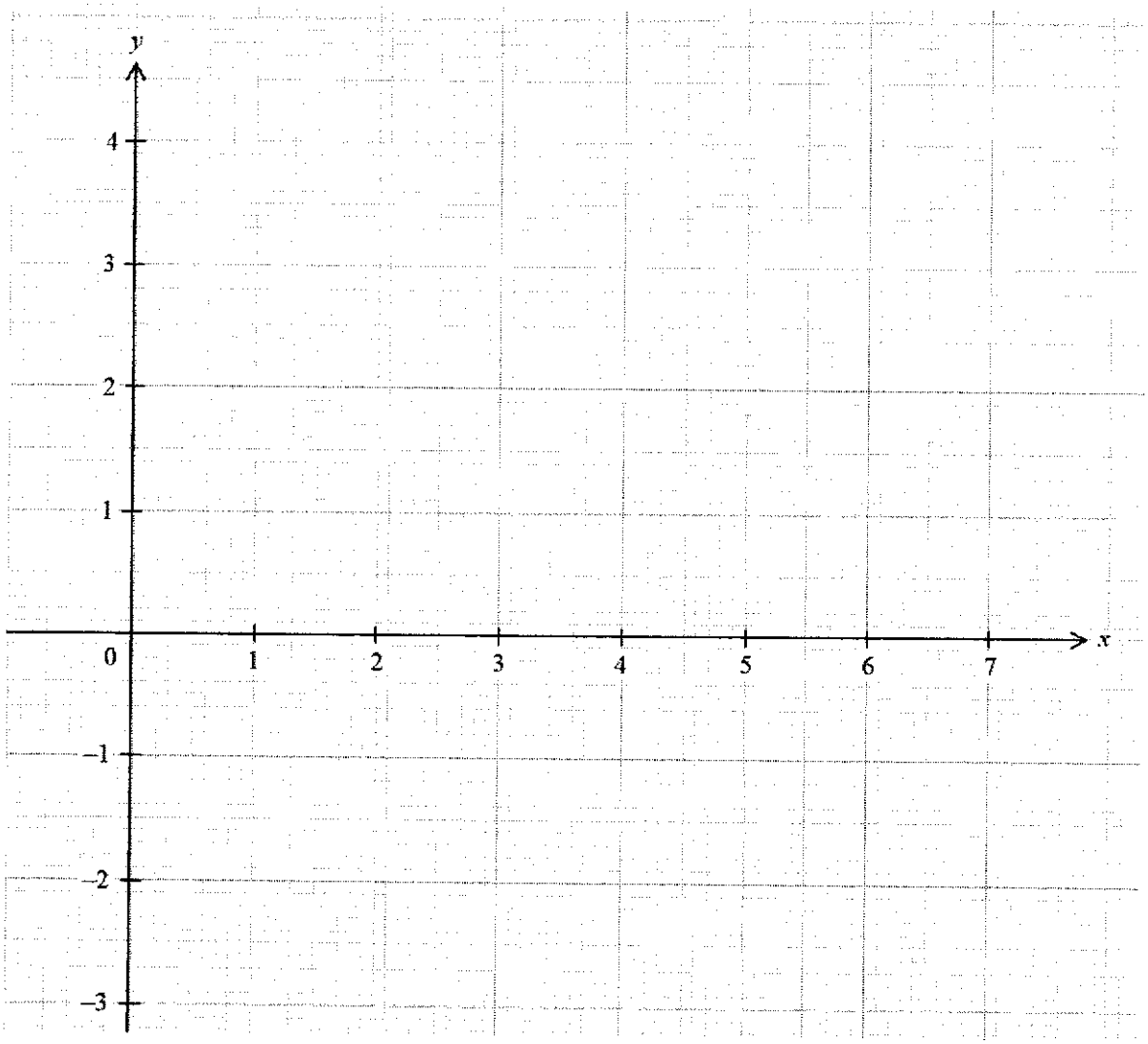
3 **(a)** The table of values for $y = x + \frac{5}{x} - 7$ is given below.

x	0.5	1	1.5	2	3	4	5	6	7
y	3.5	−1.0	−2.2	−2.5	−2.3	−1.8	k	−0.2	0.7

Find the value of k.

Answer $k =$ ..... [1]

(b) On the grid below, draw the graph of $y = x + \frac{5}{x} - 7$ for $0.5 \leq x \leq 7$ [3]



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(c) Use your graph to find the solutions to $x+\frac{5}{x}=5$ in the range of $0.5 \le x \le 7$.

Answer $x =$ ..... and ..... [3]

(d) By drawing a tangent, find the gradient of the curve at $(4, -1.8)$.

Answer Gradient = ... [2]

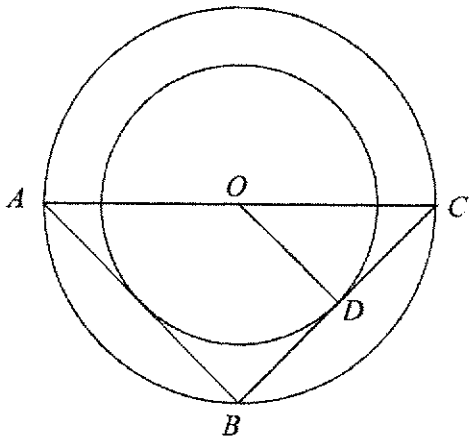
(e) The solutions of $Px^2+Qx+5=0$ are the same as the x-coordinates of the intersections between the graph $y=x+\frac{5}{x}-7$ and the line $y=-x+3$.
Find the values of P and Q.

Answer $P =$ .....

$Q =$ ..... [3]

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4 **(a)** The diagram below shows two circles, with the same centre at O.
Points A, B and C lie on the bigger circle and point D lies on the smaller circle.
AC is a straight line that passes through the centre of both circles.
AB and BC are both tangents to the smaller circle.



(i) Show that triangles ABC and ODC are similar.
Give a reason for each statement you made.

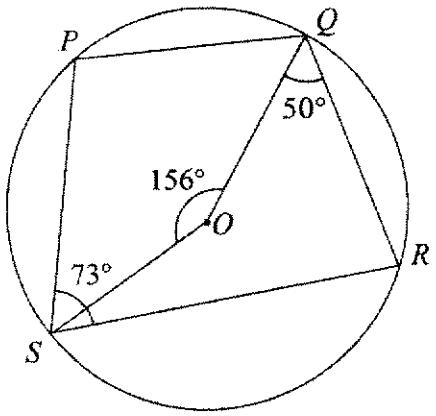
Answer [2]

(ii) The area of triangle ODC is given as 15cm^2.
Find the area of trapezium $ABDO$.

Answer ..... cm^2 [2]

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(b)



$PQRS$ are points on the circumference of a circle, centre O.
Angle $OQR = 50°$, angle $PSR = 73°$ and obtuse angle $SOQ = 156°$.

(i) Find angle QRS.
Give a reason for each step of your working.

Answer .....° [1]

(ii) Find angle PSO.
Give a reason for each step of your working.

Answer .....° [2]

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(iii) Find angle PQO.
Give a reason for each step of your working.

Answer .....° [2]

(iv) Explain whether line PQ parallel to line SR.
Support your answer with workings.

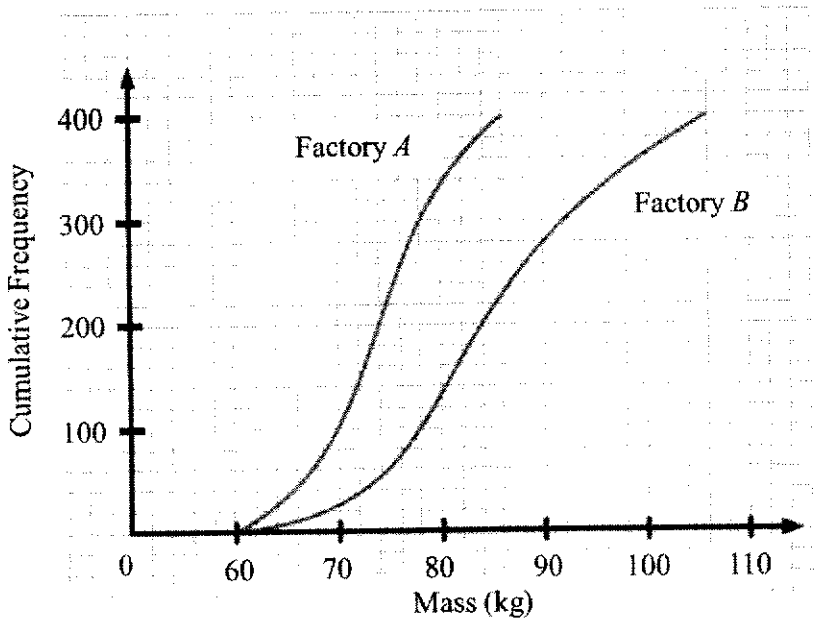
Answer : .....

.....

[2]

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5 The masses of two batches of 400 steel bars produced by factory *A* and *B* were measured and recorded. The cumulative frequency graph below shows the masses.



(a) For the steel bars produced by factory *A*, find

(i) the median,

Answer ..... kg [1]

(ii) the interquartile range.

Answer ..... kg [2]

(b) The steel bars produced by factory *B* are heavier than those produced by factory *A*. Do you agree? Explain your answer.

Answer :

.....

.....

[1]

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(c) Which factory is more consistent in the production of steel bars? Support your answer with workings.

Answer :

.....

[2]

.....

(d) One steel bar is chosen at random from factory *A* and another steel bar is chosen at random from factory *B*.

Find, as a fraction in its simplest form, the probability that both steel bars chosen are more than 80kg.

Answer ..... [3]

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6 **(a)** Point A is translated to point B by the vector $\begin{pmatrix} -5 \\ 4 \end{pmatrix}$.

The position vector of point B is $\begin{pmatrix} 3 \\ 8 \end{pmatrix}$.

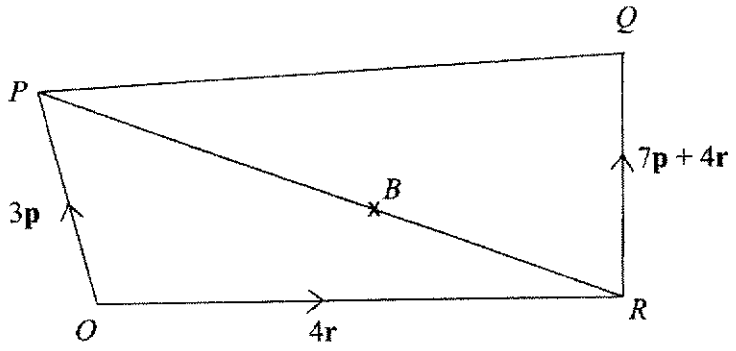
(i) Find $|\overrightarrow{OA}|$.

Answer ..... [2]

(ii) P is a point that lies on AB and has coordinates $(k, 10)$.
Find the value of k.

Answer $k =$ ..... [2]

(b)



$OPQR$ is a quadrilateral.

$\overrightarrow{OP} = 3\mathbf{p}$, $\overrightarrow{OR} = 4\mathbf{r}$ and $\overrightarrow{RQ} = 7\mathbf{p} + 4\mathbf{r}$.

B is a point on PR such that $PB : BR = 3 : 2$.

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Write each of the following in terms of **p** and **r**.
Give your answer in their simplest form.

(i) $\overrightarrow{OQ}$,

Answer ..... [1]

(ii) $\overrightarrow{PQ}$,

Answer ..... [1]

(iii) $\overrightarrow{OB}$.

Answer ..... [3]

(c) Explain why points O, B and Q are **not** collinear.

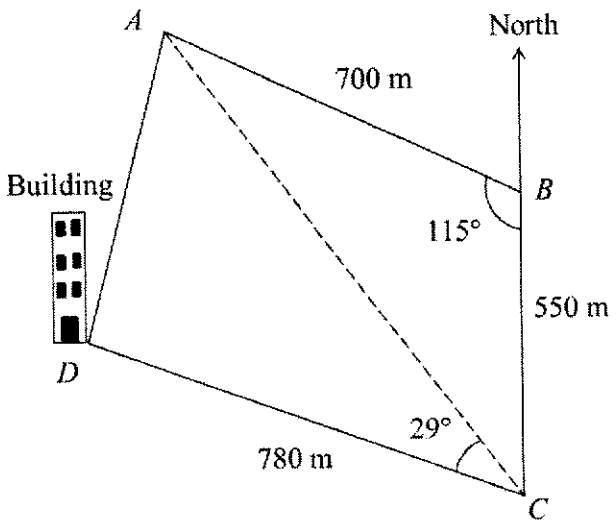
Answer :

.....

..... [1]

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7



The diagram above shows a park $ABCD$ that is on horizontal ground, crossed by a straight path AC. Point B is due north of C.

$AB = 700$ m, $BC = 550$ m and $CD = 780$ m.
Angle $ABC = 115°$ and angle $ACD = 29°$.

(a) Show that length $AC = 1057.32$ m, correct to two decimal places.

Answer [2]

(b) Calculate the bearing of D from C.

Answer .....° [3]

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(c) Find the total area of the park *ABCD*.
Correct your answer to the nearest whole number.

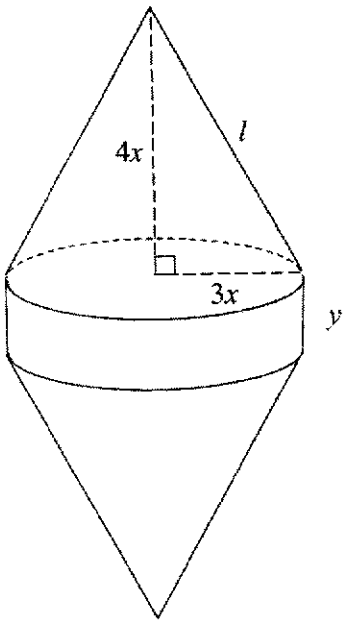
Answer ..... m^2 [2]

(d) A vertical building is located at point *D*.
The angle of elevation of the top of the building from point C is 10.9°.
Find the height of the building.

Answer ..... m [2]

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8



The diagram above shows a solid structure that is formed from two identical cones and a cylinder. The cylinder is attached to the bases of the two cones.

The cone has radius $3x$ cm, height $4x$ cm and slant height l cm.
The cylinder has radius $3x$ cm and height y cm.

(a) Express l in terms of x.

Answer $l =$ ..... [1]

(b) The volume of the cylinder is equal to the volume of one cone.

Show that $y = \frac{4}{3}x$.

Answer [2]

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(c) The total surface area of the solid structure is $(200-x)\pi$ cm^2.
Write an expression, in terms of x, for the total surface area of the solid and show that it reduces to $38x^2+x-200=0$.

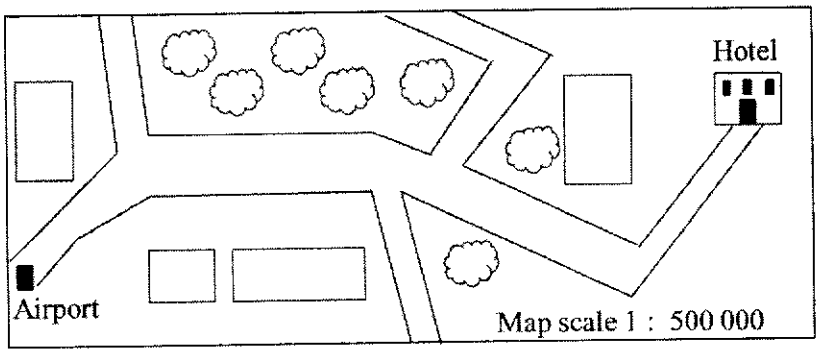
Answer [3]

(d) Solve the equation $38x^2+x-200=0$, giving your solutions correct to 2 decimal places.

Answer $x =$ ..... [3]

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9 David will travel on his own for a holiday day trip to Australia. He is planning to rent a car for a total of 9 days for the whole trip.



(a) David plans to pick up his rental car from the airport and drive from the airport to his hotel. He uses the above map, drawn to scale, to plan his way to the hotel. The above map has a scale of 1 : 500 000.

(i) Measure and estimate the total distance that David needs to drive from the airport to the hotel.

Answer ..... km [2]

(ii) Assuming that David will drive at an average speed of 65 km/h from the airport to the hotel. Calculate the time he will take to drive from airport to the hotel. Give your answer correct to the nearest minute.

Answer ..... minutes [2]

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(b) The information below contains the different costs of renting a car in Australia.

Rental charges for car.

Type of vehicle	**Daily Rental Cost (Excluding** petrol and charging costs)			**Mileage (Distance travelled based on vehicle type**
	Less than 7 days	**Less than 30 days**	**More than 30 days**	
Petrol Car (5 seater)	$125	$112.50	$93.75	10.3 km per litre of petrol
Petrol Car (7 seater)	$170	$153	$136	8.7 km per litre of petrol
Electric Car (5 seater)	$198	$178.20	$158.40	5.25 km per kWh of charge
Electric Car (7 seater)	$220	$198	$165	4.54 km per kWh of charge

Taxes

- 10% Goods and Service Tax (GST) on all purchases of goods and service in Australia.

Petrol and charging cost

Price of petrol: $3.10 per litre of petrol (excluding GST)

Charging cost: $1.25 per kWh of charge (including GST)

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(b) David estimates that his total driving distance for the whole trip will be 850 km, including the journey to and fro from the airport to the hotel.

After some calculations, David concludes that renting the electric car (5 seater) is the cheapest option for his whole trip. Do you agree with David?

Justify your answer with workings.

Answer [6]

END OF PAPER 2

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Name	Index Number	Class

WOODGROVE SECONDARY SCHOOL

A COMMUNITY OF FUTURE-READY LEARNERS AND THOUGHTFUL LEADERS

O-LEVEL PRELIMINARY EXAMINATION 2024

LEVEL & STREAM : SECONDARY 4 EXPRESS / 5 NORM[illegible]RACADEMIC

SUBJECT (CODE) : MATHEMATICS (4052)

PAPER : 01

DATE (DAY) : 27 AUGUST 2024 (TUESDAY)

DURATION : 2 HOURS 15 MINUTES

Mark Scheme

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.

The number of marks is given in brackets [ ] at the end of each question or part question.

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The total number of marks for this paper is 90.

The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer correct to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value of 3.142.

DO NOT TURN OVER THE QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

Student's Signature		**Parent's Signature**	
Date		**Date**	

90

This document consists of 20 printed pages including this cover page.

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Mathematical Formulae

Compound Interest

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

Mensuration

Curved surface area of a cone $= \pi rl$

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

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

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

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

Arc length $= r\theta$, where θ 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

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$$

$$\text{Standard Deviation} = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$$

BP~779

BP~780

Answer all the questions.

1 **(a)** Calculate $\dfrac{-11+\sqrt{(-11)^2-\dfrac{20}{11}}}{8\times 0.6}$.

Write your answer correct to 4 significant figures.

-0.01728 ----------B1

Answer ..... [1]

(b) Write your answer to **part (a)** in standard form.

-1.728×10^{-2} ----------B1

Answer ..... [1]

2 Expand and simplify $(2x+5)(3+4x)$.

$(2x+5)(3+4x)$

$=6x+8x^2+15+20x$ ----------M1

$=8x^2+26x+15$ ----------A1

Answer ..... [2]

3 Solve

(a) $3-4x=21$.

$3-4x=21$

$-4x=18$

$x=-\dfrac{9}{2}$ or $-4\dfrac{1}{2}$ or -4.5 ----------B1

Answer ..... [1]

(b) $2x<3x+1\le13$,

$2x<3x+1$ $\quad$ $3x+1\le13$

$-x<1$ $\quad$ $3x\le12$

$x>-1$ $\quad$ $x\le4$ --------M1

$-1<x\le4$---------A1

Answer ..... [2]

4 **(a)** Express 4312 as a product of its prime factors.

$2^3\times7^2\times11$ ----------B1

Answer ..... [1]

(b) Given $588=2^2\times3\times7^2$.

Find

(i) The largest integer which is a factor of both 588 and 4312.

196 ----------B1

Answer ..... [1]

(ii) The smallest integer which is the multiple of both 588 and 4312.

12936 ----------B1

Answer ..... [1]

(iii) The smallest integer value of m such that $4312m$ is a perfect square.

22 ----------B1

Answer ..... [1]

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5 Given that the coordinates of point A is $(-2,11)$ and point B is $(5,-11)$.

Find

(a) length AB,

length $AB = \sqrt{(-11-11)^2+(5-(-2))^2}$ ----------M1

$=\sqrt{533}$

$=23.086$

$=23.1$ (3sf) ----------A1

Answer ..... [2]

(b) equation of the straight-line AB.

gradient $m = \dfrac{-11-11}{5-(-2)}$

$= -\dfrac{22}{7}$ ----------M1

$11 = -\dfrac{22}{7}(-2)+c$

$11 = \dfrac{44}{7}+c$

$c = -\dfrac{33}{7}$ ----------M1

$y = -\dfrac{22}{7}x - \dfrac{33}{7}$ ----------A1

Answer ..... [3]

6 Simplify $\dfrac{9x^2-4}{12x^2-x-6}$.

$\dfrac{9x^2-4}{12x^2-x-6} = \dfrac{(3x-2)(3x+2)}{(3x+2)(4x-3)}$ ---------- M2

$= \dfrac{(3x-2)}{(4x-3)}$ ---------- A1

Answer ..... [3]

7 Solve $\dfrac{2}{x+1}-3 = \dfrac{1}{2x-5}$.

$\dfrac{2}{x+1}-3 = \dfrac{1}{2x-5}$

$\dfrac{2-3(x+1)}{x+1} = \dfrac{1}{2x-5}$

$\dfrac{2-3x-3}{x+1} = \dfrac{1}{2x-5}$

$\dfrac{-3x-1}{x+1} = \dfrac{1}{2x-5}$ ----------M1

$(-3x-1)(2x-5) = x+1$

$-6x^2+15x-2x+5 = x+1$

$-6x^2+13x-x+5-1 = 0$

$-6x^2+12x+4 = 0$

$3x^2-6x-2 = 0$ ----------M1

$x = \dfrac{6 \pm \sqrt{(-6)^2-4(3)(-2)}}{2(3)}$

$= \dfrac{6 \pm \sqrt{60}}{6}$ ----------M1

$= \dfrac{6+\sqrt{60}}{6}$ or $\dfrac{6-\sqrt{60}}{6}$

$= 2.29$ or -0.291 (3sf) ----------A1

Answer ..... [4]

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8 The table below shows a multiple-choice test Sam and Roger took.

	Correct	No attempt	Incorrect
Sam	14	5	1
Roger	15	0	5

(a) Represent this information in a 2×3 matrix, **S**.

$\begin{pmatrix}14 & 5 & 1\\ 15 & 0 & 5\end{pmatrix}$ ----------B1 $\mathbf{S}=\begin{pmatrix} & & \\ & & \end{pmatrix}$

Answer [1]

(b) The marks are awarded as follow:

Correct = 2 marks
No attempt = 0 mark
Incorrect = -1 mark

Represent the information in a 3×1 matrix, **T**.

Evaluate **ST**

$T=\begin{pmatrix}2\\0\\-1\end{pmatrix}$ ----------M1

$\begin{pmatrix}14 & 5 & 1\\ 15 & 0 & 5\end{pmatrix}\begin{pmatrix}2\\0\\-1\end{pmatrix}=\begin{pmatrix}27\\25\end{pmatrix}$ ----------A1

Answer ..... [2]

(c) Explain what your answer to **(b)** represents.

Total score Sam and Roger get respectively----------B1

Answer .....

.....

.....

..... [1]

9 Factorise completely.

(a) $abc-3c-6+2ab$

$abc-3c-6+2ab$
$=abc-3c+2ab-6$
$=c(ab-3)+2(ab-3)$ ----------M1
$=(ab-3)(c+2)$ ----------A1

Answer ..... [2]

(b) $80x^4-5$

$80x^4-5$
$=5(16x^4-1)$ ----------M1
$=5(4x^2+1)(4x^2-1)$ ----------M1
$=5(4x^2+1)(2x+1)(2x-1)$ ----------A1

Answer ..... [3]

10 Ken divides his monthly salary into daily expenses, spending and saving in the ratio 3:4:5 respectively. Later he decides to spend \$1200 more daily the new ratio become 9:8:7. Calculate his monthly salary.

3 : 4 : 5

6 : 8 : 10 ----------M1

3 units represent \$1200 ----------M1

1 unit represent \$400

24 units represent 24 × \$400 = \$9600 ----------A1

Answer ..... [3]

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11 John conducted a survey on the average time spent reading per week. This survey was carried out outside Woodlands Regional Library. The table below represents the survey results.

Time spends (t) in hours	$0 \le t < 2$	$2 \le t < 4$	$4 \le t < 6$	$6 \le t < 8$	$8 \le t < 10$	$10 \le t < 12$
Frequency	3	8	9	15	3	2

(a) Calculate the percentage of people spend between 6 to 8 hours per week in reading.

$\frac{15}{40} \times 100\%$
$= 37.5\%$ ----------B1

Answer .....% [1]

(b) Calculate the average time spend in reading.

5.65 hours ----------B1

Answer ..... hours [1]

(c) John concludes that the result in **part (b)** is the average of time spent in reading by a Singaporean. Do you agree, give a reason.
No, because the survey is done outside a library people who tends to read more[1]
therefore it is bias [1]
Answer .....
.....
.....
.....
..... [2]

12 The expression $x^2 - 4x + 7$ can be written in the form of $(x-a)^2 + b$

(a) Find the value of a and b.

$x^2 - 4x + 7$
$= (x-2)^2 - 4 + 7$
$= (x-2)^2 + 3$
$a = 2$
$b = 3$

Answer a= ..... [1]

b= ..... [1]

(b) Explain why the expression gives a minimum value.

Answer

$(x-2)^2 \ge 0$ ----------M1
the smallest it can have is 0.
therefore the expression gave a minimum values --------A1

[2]

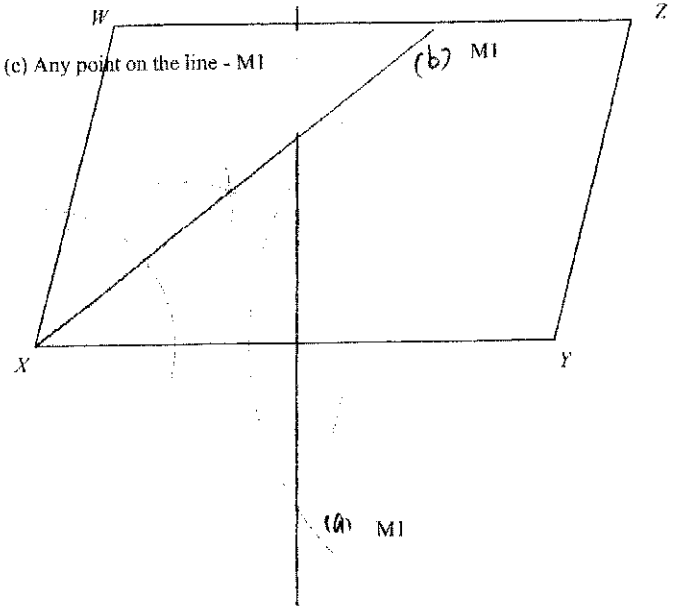
(c) Write down the minimum value.
3 ----------B1

Answer ..... [1]

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BP~784

13 The diagram shows a quadrilateral $WXYZ$.

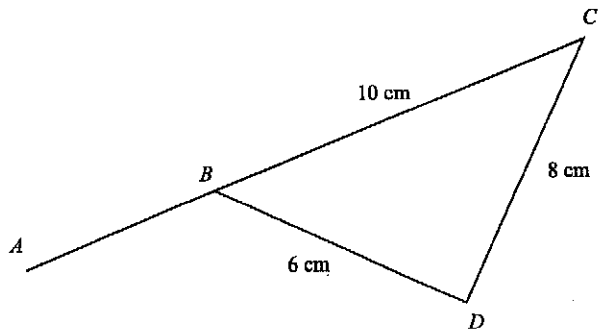


(a) Construct the perpendicular bisector of XY. [1]

(b) Construct the bisector of angle WXY. [1]

(c) Point A in the quadrilateral is equidistant from X and Y **and** is closer to the line WX then to line XY.
Mark and label a possible location for point A in the diagram above. [1]

14 In the diagram ABC is a straight line, $BC = 10$ cm, $CD = 8$ cm and $BD = 6$ cm.



(a) Explain why a circle that passes through B, C and D can be drawn in the above diagram.
Give reasons for each step of your working.

Answer

$BC^2 = 100$

$BD^2 + CD^2 = 64 + 36$

$= 100$

$BD^2 + CD^2 = BC^2$ ----------M1

by the converse of Pythagoras' theorem

angle BDC is 90°----------M1

a circle that passes through B, C and D can be drawn

(angle in semi circle)----------A1

[3]

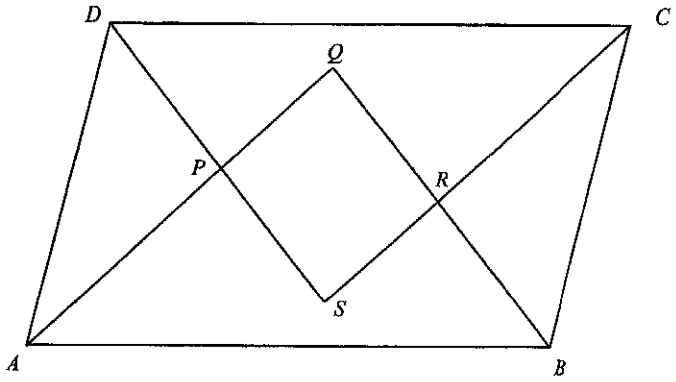
(b) Hence find the exact value of cos ABD

$-\frac{3}{5}$ ----------B1

Answer ..... [1]

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15 The diagram shows a parallelogram $ABCD$. APQ, BRQ, CRS and DPS are straight lines which bisect angles A, B, C and D respectively.



(a) Show that angle PAD = angle RCB. [2]

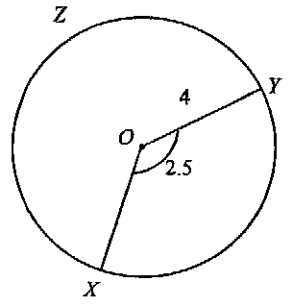
Answer:
$\angle DAB = \angle BCD$ (opposite angle of parallelogram) ----------M1
$\angle DAP = \angle PAB = \angle BCR = \angle RCD$ (bisect angle)
$\therefore \angle PAD = \angle RCB$ ----------A1

(b) Prove that triangles ADP and CBR are congruent. [3]

Answer:
in triangle ADP and triangle CBR,
$\angle PAD = \angle RCB$ (from (a))
$AD = CB$ opposite side of parallelogram ----------M1
$\angle ADP = \angle CBR$ ----------M1
$\therefore$ triangle ADP and triangle CBR (ASA) ----------A1

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16 X, Y and Z lie on a circle with centre O and radius 4 cm.
Angle $XOY = 2.5$ radians.



(a) Find the area of minor sector XOY.

Area of Sector $= \frac{1}{2} r^2 \theta$
$= \frac{1}{2}(4)^2 \times 2.5$
$= 20 \text{ cm}^2$ ----------B1

Answer .....cm^2 [1]

(b) **(i)** Write down, in term of π, for reflex angle XOY.

$2\pi - 2.5$ ----------B1

Answer ..... [1]

(ii) Find the length of the arc XZY, in term of π.

$4(2\pi - 2.5)$
$= (8\pi - 10)$ ----------B1

Answer .....cm [1]

(iii) The major sector $XZYO$ is used to make a cone.
Calculate the base radius of the cone.

$4(2\pi - 2.5) = 2\pi r$ ----------M1
$r = \frac{4(2\pi - 2.5)}{2\pi}$
$r = 2.41$ ----------A1

Answer .....cm [2]

17 (a) Simplify.

(i) $\frac{a^3}{3a^2}\times 27a^6$

$\frac{a^3}{3a^2}\times 27a^6$

$=\frac{9a^3}{a^2}\times a^6$ ----------M1

$=9a^7$ ----------A1

Answer ..... [2]

(ii) $\sqrt{16x^{\frac{4}{3}}}$

$\sqrt{16x^{\frac{4}{3}}}=4\left(x^{\frac{4}{3}}\right)^{\frac{1}{2}}$ ----------M1

$=4x^{\frac{2}{3}}$ ----------A1

Answer ..... [2]

(b) $\frac{49^{2a}}{7^b}=343^{4c}$. Find an expression for b in terms of a and c.

$\frac{49^{2a}}{7^b}=343^{4c}$

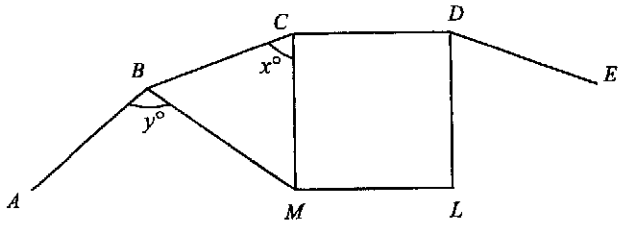
$\frac{7^{4a}}{7^b}=7^{12c}$ ----------M1

$4a-b=12c$ ----------M1

$b=4a-12c$ ----------A1

Answer ..... [3]

18 *ABCDE* is part of a regular polygon which has an exterior angle of 20°. *CDLM* is a square.



Find

(a) the value of x,

$\angle BCD=180-20$

$=160$ ----------M1

$x=160-90$

$=70$ ----------A1

°

Answer ..... [2]

(b) the value of y.

$\angle MBC=\frac{180-70}{2}$

$=55$ ----------M1

$y=160-55$

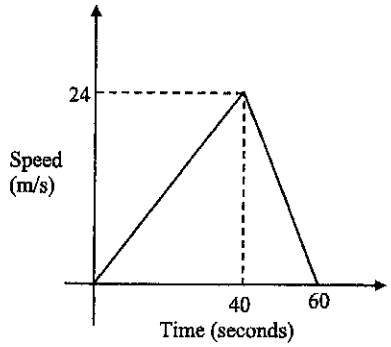
$=105$ ----------A1

°

Answer ..... [2]

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19 The diagram below shows the speed-time graph of a car's journey.



For this journey, calculate

(a) the acceleration during the first 40 seconds,

$a = \frac{24}{40}$

$= 0.6$ ----------B1

Answer ..... m/s^2 [1]

(a) The total distance travelled.

Total distance travelled $= \frac{1}{2} \times 60 \times 24$

$= 720$ ----------B1

Answer ..... m [1]

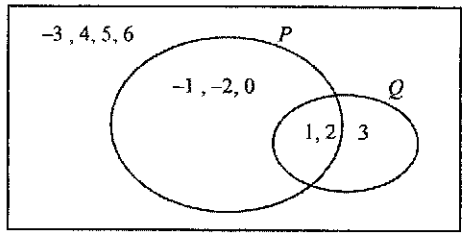
20 $\xi = \{ x : x \text{ is an integer and } -3 \le x < 7 \}$

$P = \{ x : -3 < x < 3 \}$

$Q = \{ x : 0 < x \le 3 \}$

(a) Draw a Venn diagram below to illustrate this information. [1]

ξ



(b) List the elements in

(i) P',

{–3, 3, 4, 5, 6} ----------B1

Answer ..... [1]

(ii) $P \cap Q$.

{1, 2} ----------B1

Answer ..... [1]

(c) Write down $n(P \cup Q)$

7 ----------B1

Answer ..... [1]

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BP~788

21 The first four terms in a sequence of numbers, $x_1, x_2, x_3, x_4, \ldots$ are given below.

$$x_1=2(0)+1=1$$
$$x_2=2(1)+3=5$$
$$x_3=2(2)+5=9$$
$$x_4=2(3)+7=13$$

(a) Write down an expression for x_5.

17 ----------B1

Answer ..... [1]

(b) Find an expression, in term of n, for the n^{th} term, x_n, of the sequence.

$x_n = 2(n-1)+1+2(n-1)$ ----------M1

$= 2n-2+1+2n-2$

$= 4n-3$ ----------A1

Answer ..... [2]

(c) Evaluate x_{20}

$x_{20} = 4(20)-3$

$= 77$ ----------B1

Answer ..... [1]

(d) Explain why 203 is not a term of this sequence.

Answer

$x_n = 4n-3$

$203 = 4n-3$

$4n = 206$

$n = 51.5$

Since n is not a positive integer, [1]

therefore 203 is not a term of this sequence [1]

[2]

22 A survey was carried out to find out the number of emails received in a week by each of a group of students.

The table below represents the result of the survey.

Number of emails (n)	Frequency
$0 \le n < 10$	8
$10 \le n < 20$	13
$20 \le n < 30$	25
$30 \le n < 40$	30
$40 \le n < 50$	18
$50 \le n < 60$	6

(a) Find the probability that two students, chosen in random, both received at least 40 emails.

$\frac{24}{100} \times \frac{23}{99}$ ----------M1

$= \frac{46}{825}$ ----------A1

Answer ..... [2]

(b) Which interval contain the median number of emails received by the students.

$30 \le n < 40$ ----------B1

Answer ..... [1]

(c) Calculate an estimate of the mean number of emails received by the students.

30.5 ----------B1

Answer ..... [1]

(d) Calculate an estimate of the standard deviation.

$SD = \sqrt{\frac{110100}{100} - (30.5)^2}$ ----------M1

$= 13.1$ ----------A1

Answer ..... [2]

END OF PAPER 1

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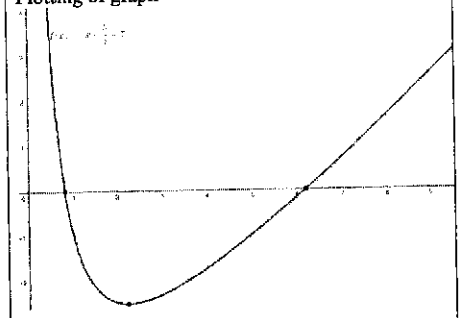
			Solution	Marks	Remarks
1	(a)	(i)	$b=\frac{a}{a-1}+\frac{2}{c}$ $b=\frac{3}{3-1}+\frac{2}{4}$ $b=2$	B1	
		(ii)	$b=\frac{a}{a-1}+\frac{2}{c}$ $b=\frac{ac}{(a-1)c}+\frac{2(a-1)}{c(a-1)}$ $bc(a-1)=ac+2a-2$ $abc-bc=ac+2a-2$ $abc-ac-2a=bc-2$ $a(bc-c-2)=bc-2$ $a=\frac{bc-2}{bc-c-2}$ or $\frac{2-bc}{2-bc+c}$	M1 M1 A1	Combine fractions, common denominator Grouping of 'a' terms and factorising
	(b)		$4x-y=-11$ ------- (1) $5x+3y=-1$ ------- (2) (1) ×3 $12x-3y=-33$ ------- (3) (2) + (3) $17x=-34$ $x=-2$ Sub $x=-2$ into (1) $4(-2)-y=-11$ $-y=-11+8$ $y=3$	M1 A1 A1	Elimination method
			Alternate solution : solving by substitution		
			$4x-y=-11$ ------- (1) $5x+3y=-1$ ------- (2) From (1) $4x-y=-11$ $y=4x+11$ ------- (3)	M1	Substitution method

			Sub (3) into (2) $5x+3(4x+11)=-1$ $5x+12x+33=-1$ $7x=-34$ $x=-2$ Sub $x=-2$ into (3) $y=4(-2)+11$ $y=3$	A1 A1	
	(c)		$\frac{x}{3x-1}-\frac{5}{2x+3}=1$ $\frac{x(2x+3)}{(3x-1)(2x+3)}-\frac{5(3x-1)}{(3x-1)(2x+3)}=1$ $\frac{2x^2+3x-15x+5}{(3x-1)(2x+3)}=1$ $2x^2+3x-15x+5=6x^2+9x-2x-3$ $4x^2+19x-8=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-19\pm\sqrt{(19)^2-4(4)(-8)}}{2(4)}$ $x=\frac{-19\pm\sqrt{489}}{8}$ $x=0.38916$ or -5.1391 $x=0.389$ or -5.139 (to 3 dp)	M1 M1 M1 A1	Combine fraction, common denominator $4x^2+19x-8=0$ $x=\frac{-19\pm\sqrt{489}}{8}$ Both answers
2	(a)		**Plan *B*.** Plan *B* pays a higher interest amount as it is **compounded** yearly. Or the **principal sum increases** every year.	B1	
	(b)		Total simple interest $=8000\times\frac{3.5}{100}\times12$ $=\$3360$ Total amount = 8000 + 3360 = $11360	M1 A1	Interest = $3360

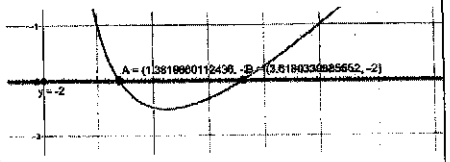
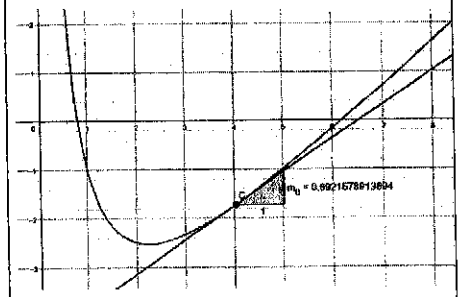
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	(c)		$50000\left(1+\frac{r}{100}\right)^{14}=65320$ $\left(1+\frac{r}{100}\right)=1.01927$ $r=1.92744$ $r=1.93\%$ (to 3 sf)	M1 M1 A1	M1: forming equations using compound interest M1: 1.01927
	(d)		Discounted price in THB $56000\times0.85=47600$ THB Total cost in THB $47600\times1.02=48552$ THB Cost in SGD $=\frac{48552}{27.16}$ $=1787.6288$ $=\$1787.63$ (to nearest cent)	M1 M1 A1	47600 THB (after discount) and Multiply by 1.02 Divide by exchange rate
3	(a)		$y=x+\frac{5}{x}-7$ $y=5+\frac{5}{5}-7=-1$ $k=-1$	B1	
	(b)		Plotting of graph 	G1 G1 G1	G1: 0 – 4 points plotted correctly G1: all points plotted correctly G1: smooth curve

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	(c)		$x+\frac{5}{x}=5$ $x+\frac{5}{x}-7=5-7$ $y=-2$ Intersection points  $x=1.4\pm0.1$ $x=3.6\pm0.1$	M1 A1 A1	M1: draw $y=-2$
	(d)		Drawing of suitable tangent line at $(4,\ -1.8)$  Estimated gradient = 0.688 ± 0.1 (3sf as its an estimate of the gradient)	M1 A1	
	(e)		$x+\frac{5}{x}-7=-x+3$ $x^2+5-7x=-x^2+3x$ $2x^2-10x+5=0$ $P=2$ and $Q=-10$	M1 A1 A1	Equating both equations

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4	(a)	(i)	- Angle ACB equal to angle OCD (Common angle) (A) - Angle $ABC = 90°$ (angle in semi circle) and Angle $ODC = 90°$ (tangent to radius) (A) Hence using **AA test**, triangles ABC and ODC are similar.(AA)	B1 B1	* minus 1 mark if student did not state the test used.
		(ii)	$\frac{\text{Area triangle } ABC}{\text{Area triangle ODC}} = \left(\frac{2}{1}\right)^2$ $\frac{\text{Area triangle } ABC}{15} = \left(\frac{4}{1}\right)$ Area triangle $ABC = 60$ Trapezium $ABDO = 60 - 15 = 45\text{cm}^2$	M1 A1	M1: 60
	(b)	(i)	angle QRS $= \frac{156}{2} = 78°$ (angle at centre is twice angle at circumference)	B1	*minus maximum of 1 mark if no reasons are give for whole of Q4(b). But to circle and highlight to student importance of following question and give reasons to support answer.
		(ii)	angle SRO $= 78° - 50°$ (Isosceles triangle) $= 28°$ angle $RSO = 28°$ (Isosceles triangle) angle PSO $= 73° - 28°$ $= 45°$	M1 A1	*also accept other correct methods of finding answer e.g. angles in opp segment (longer method)

		(iii)	angle PQR $= 180° - 73°$ (Angles in opposite segment) $= 107°$ angle PQO $= 107° - 50°$ $= 57°$	M1 A1	
		(iv)	angle PQR + angle SRQ $= 107° + 78°$ $= 185°$ angle PQR + angle SRQ is not equal to $180°$, using the rule of interior angles in parallel lines, PQ **is not parallel** to SR.	M1 A1	Add up both angles to get $185°$
5	(a)	(i)	Median = 74kg	B1	
		(ii)	Q3 = 78kg Q1= 70kg Interquartile range $= 78 - 70$ $= 8$kg	M1 A1	M1: Q3 – Q1
	(b)		Yes I agree because the **median of factory B is larger** than the median of factory A.	B1	Larger median for factory B
	(c)		Interquartile range for factory B $= 92 - 78$ $= 14$kg Since the IQR for A is smaller than B, factory A is more consistent.	M1 A1	IQR for factory B
	(d)		Factory A, more than 80kg $= 400 - 340$ or $= 400 - 330$ $= 60$ or $= 70$ Factory B, more than 80kg $= 400 - 140$ or $= 400 - 130$ $= 260$ or $= 270$	M1	M1: demo understanding of finding number of steel bars more than 80kg

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			P(both more than 80kg) $=\frac{60}{400}\times\frac{260}{400}$ $=\frac{39}{400}$ **Also accept $\frac{81}{800},\frac{91}{800},\frac{189}{1600}$	M1 A1	M1: multiplication of probability
6	(a)	(i)	$\overrightarrow{AB}=\overrightarrow{OB}-\overrightarrow{OA}$ $\begin{pmatrix}-5\\4\end{pmatrix}=\begin{pmatrix}3\\8\end{pmatrix}-\overrightarrow{OA}$ $\overrightarrow{OA}=\begin{pmatrix}3+5\\8-4\end{pmatrix}=\begin{pmatrix}8\\4\end{pmatrix}$ $\lvert\overrightarrow{OA}\rvert=\sqrt{64+16}=\sqrt{80}=8.94$ (to 3sf)	M1 A1	M1: $\overrightarrow{OA}=\begin{pmatrix}3+5\\8-4\end{pmatrix}=\begin{pmatrix}8\\4\end{pmatrix}$
		(ii)	Gradient AP = Gradient PB $\frac{10-4}{k-8}=\frac{10-8}{k-3}$ $6k-18=2k-16$ $4k=2$ $k=\frac{1}{2}$	M1 A1	M1: equating the gradients Also accept $\overrightarrow{AP}=\lambda\overrightarrow{PB}$ where λ is a constant
	(b)	(i)	$\overrightarrow{OQ}=\overrightarrow{OR}+\overrightarrow{RQ}$ $\overrightarrow{OQ}=4\mathbf{r}+7\mathbf{p}+4\mathbf{r}$ $\overrightarrow{OQ}=7\mathbf{p}+8\mathbf{r}$	B1	
		(ii)	→ → →		

			$PQ=OQ-OP$ $\overrightarrow{PQ}=7\mathbf{p}+8\mathbf{r}-3\mathbf{p}$ $\overrightarrow{PQ}=4\mathbf{p}+8\mathbf{r}$	B1	
		(iii)	$\overrightarrow{PR}=\overrightarrow{OR}-\overrightarrow{OP}$ $\overrightarrow{PR}=4\mathbf{r}-3\mathbf{p}$ $\overrightarrow{PR}=-3\mathbf{p}+4\mathbf{r}$ $\frac{PB}{PR}=\frac{3}{5}$ $\overrightarrow{PB}=\frac{3}{5}\times(-3\mathbf{p}+4\mathbf{r})$ $\overrightarrow{PB}=-\frac{9}{5}\mathbf{p}+\frac{12}{5}\mathbf{r}$ $\overrightarrow{OB}-\overrightarrow{OP}=-\frac{9}{5}\mathbf{p}+\frac{12}{5}\mathbf{r}$ $\overrightarrow{OB}=-\frac{9}{5}\mathbf{p}+\frac{12}{5}\mathbf{r}+3\mathbf{p}$ $\overrightarrow{OB}=\frac{6}{5}\mathbf{p}+\frac{12}{5}\mathbf{r}$	M1 M1 A1	M1: $\overrightarrow{PR}=-3\mathbf{p}+4\mathbf{r}$ M1: $\overrightarrow{PB}=-\frac{9}{5}\mathbf{p}+\frac{12}{5}\mathbf{r}$
	(d)		$\overrightarrow{OB}=\frac{6}{5}\mathbf{p}+\frac{12}{5}\mathbf{r}=\frac{6}{5}(\mathbf{p}+2\mathbf{r})$ $\overrightarrow{OQ}=7\mathbf{p}+8\mathbf{r}$ Points O, B and Q are not colinear because OB **cannot be expressed as a scalar multiple** of OQ.	 B1	
7	(a)		$AC^2=AB^2+BC^2-2(AB)(BC)\cos ABC$ $AC^2=700^2+550^2-2(700)(550)\cos 115$ $AC^2=1117916.062$ $AC=1057.32$m (shown)	M1 A1	Cosine rule

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	(b)		$\frac{\sin BCA}{700}=\frac{\sin 115}{1057.315}$ $\sin BCA = 0.6000250$ $BCA = 36.871°$ Bearing of D from $C = 360-29-36.871°$ $= 294.12°$ $= 294.1°$ (to 1 dp)	M1 M1 A1	M1: sine rule M1: $BCA = 36.871°$
	(c)		Area of ABC $=\frac{1}{2}(700)(550)\sin 115$ $=174464.249$ Area of ACD $=\frac{1}{2}(780)(1057.32)\sin 29$ $=199913.574$ Total Area $ABCD$ $=174464.249+199913.574$ $=374377.823$ $=374378$ (to nearest whole number)	M1 A1	M1: use of $\frac{1}{2}ab\sin C$ *Also accept $=374376.9717$ $=374377$ (to nearest whole number)
	(d)		$\tan 10.9 = \frac{height}{CD}$ $\tan 10.9 = \frac{height}{780}$ $height = 150.204$ $height = 150$m (to 3 sf)	M1 A1	M1: $\tan 10.9 = \frac{height}{CD}$
8	(a)		$l^2 = (3x)^2 + (4x)^2$ $l^2 = 25x^2$ $l = 5x$	 B1	Pythagoras' Theorem

	(b)		$\pi(3x)^2(y) = \frac{1}{3}\pi(3x)^2(4x)$ $y = \frac{1}{3}(4x)$ $y = \frac{4}{3}x$ (Shown)	M1 A1	M1: equate both volumes
	(c)		Total curved surface area of 2 cones $2\times\pi(3x)(5x)$ $=30x^2\pi$ Curved surface of cylinder $2\times\pi\times 3x\times\frac{4}{3}x$ $=8x^2\pi$ Therefore $30x^2\pi+8x^2\pi=(200-x)\pi$ $38x^2+x-200=0$ (Shown)	 M1 M1 A1	 Finding total curved surface area of 2 cones Finding Curved surface of cylinder
	(d)		$38x^2+x-200=0$ $x=\frac{-(1)\pm\sqrt{(1)^2-4(38)(-200)}}{2(38)}$ $x=\frac{-1\pm\sqrt{30401}}{76}$ $x=2.28$ (2dp) or $x=-2.31$ (NA)	M1 M1 A1	$x=\frac{-(1)\pm\sqrt{(1)^2-4(38)(-200)}}{2(38)}$ $x=\frac{-1\pm\sqrt{30401}}{76}$ $x=2.28$ (2dp)
9	(a)	(i)	Measured distance from airport to hotel = 11.5cm Accept 11.0 to 12.5 cm 1 : 500 000 1cm : 5 km Actual distance : 55km to 62.5km	 M1 A1	 Accept 11.0 to 12.5 cm 55km to 62.5km

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		(ii)	Time taken in mins $= \frac{55}{65} \times 60 = 50.8$ mins or Time taken in mins $= \frac{62.5}{65} \times 60 = 57.7$ mins	M1	Calculating time taken in mins
			Time taken : 51 to 58 minutes (accept ans within range)	A1	
	(b)		Electric vehicle Daily rental : 9 days X 178.20 X 1.10 = **$1764.18** Charging cost: $= \frac{850}{5.25} \times 1.25 = \$202.380$ Total cost for electric vehicle (5 seater) = 1764.18+ 202.380 = $1966.56	M1 M1 M1	M1: calculating daily rental with 5 seater electric car M1: calculating total charging cost M1: total cost for electric car
			Petrol vehicle (5 seater) Daily rental : 9 days X **112.50** X 1.10 = $1113.75 Petrol costs $= \frac{850}{10.3} \times 3.10 \times 1.10 = \$281.407$ Total cost for petrol vehicle (5 seater) = $1113.75+ $281.407 = $1395.1577 = $1395.16 (2 dp) No, the cost of electric car is higher than petrol car, hence David is not correct.	M1 M1 A1	M1: calculating daily rental with 5 seater petrol car M1: calculating petrol cost

END OF MARKING SCHEME PAPER 2

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