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Name:_____ **Class**_____ **Index No**____

BUKIT PANJANG GOVERNMENT HIGH SCHOOL

PRELIMINARY EXAMINATION 2020

SECONDARY FOUR EXPRESS

SECONDARY FIVE NORMAL ACADEMIC

MATHEMATICS **4048/1**

Paper 1 Date: 28 Aug 2020

Candidates answer on the question paper. Time: 0800 – 1000 hours

No additional materials are required. Duration: 2h

READ THESE INSTRUCTIONS FIRST

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

Answer all questions.
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 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 to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This paper has a total of 23 pages.

Setter: Mr KH Chiam **[Turn over]**

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Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

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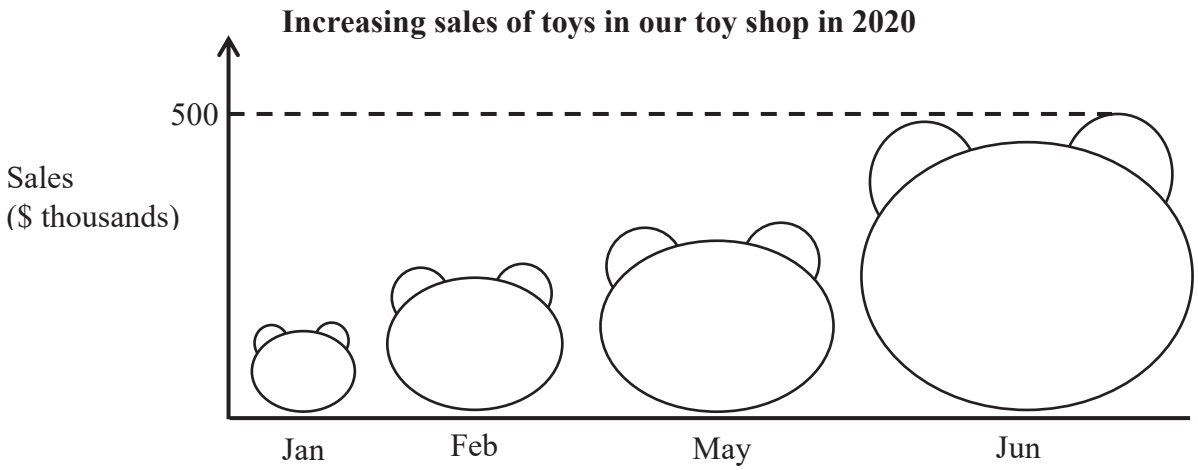
Answer **all** the questions

1 The number of beans in a bowl is given as 120, correct to the nearest ten.
Write down the minimum number of beans that could be in the bowl at this time.

Answer _____[1]

2 A toy shop put up this chart.



State one aspect of the graph that may be misleading and explain how this may lead to a misinterpretation of the graph.

_____

_____

_____

_____ [2]

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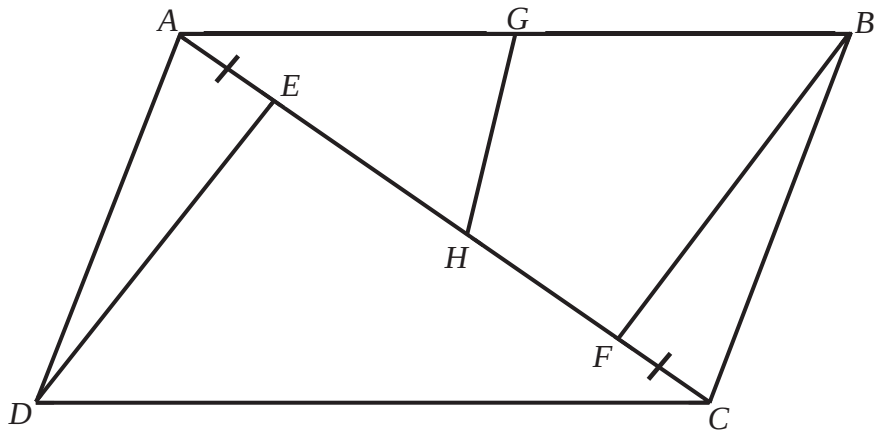
3 For the parallelogram $ABCD$, $AE = CF$. DE is parallel to BF. G is the mid-point of AB.

a. Show that ΔDAE is congruent to ΔBCF.



[2]

b. Triangle AGH is similar to triangle ACB, $AB = 2$ m and $AC = 2.1$ m,
John claims that the length of AH is half of the length of AC. Using appropriate calculations, comment on the correctness of John's claim. [3]

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4 (a) Express 540 as a product of its prime factors.

Answer _____ [1]

(b) The number $\frac{540p}{q}$ is a perfect square.

p and q are prime numbers.

Find the smallest value of p and the corresponding value of q.

Answer p = _____ [1]

q = _____ [1]

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5 Express $8\frac{3}{4}\%$ as a

(a) decimal,

(b) fraction in its simplest form.

Answer *(a)* _____ [1]

(b) _____ [1]

6 A farm rears chickens and sheep.
Each chicken has 2 legs and each sheep has 4 legs.
The total number of legs is 100 while the total number of heads is 35.
Let the number of chickens be c and the number of sheep be s.

Solve for the values of c and s.

Answer c = _____

s = _____[3]

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7 A bag contains 10 red marbles, 3 blue marbles and 2 white marbles.
Ethan picked two marbles at random.
Calculate the probability that he picked at least 1 white marble.

Answer _____[2]

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8 (a) Solve the inequalities $2 \leq 3x + 2 < 17$.

Answer _____[2]

(b) List all the prime numbers such that $2 \leq 3x + 2 < 17$.

Answer _____[1]

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9 I is inversely proportional to the square of r.

(a) When $r = \frac{1}{5}$, $I = 500$. Find I when $r = \frac{1}{10}$.

Answer _____[2]

(b) When the value of r is tripled, find the percentage decrease in the value of I.

Answer _____% [2]

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10 Find **two pairs of numbers**, all numbers being smaller than 1400, that have a lowest common multiple of 5400 and a highest common factor of 90.

Answer _____ and _____ [3]

11 (a) Factorise $4a^2 + 12ab + 9b^2$

Answer _____ [1]

(b) Hence, completely factorise $4a^2 + 12ab + 9b^2 - 1$

Answer_____[2]

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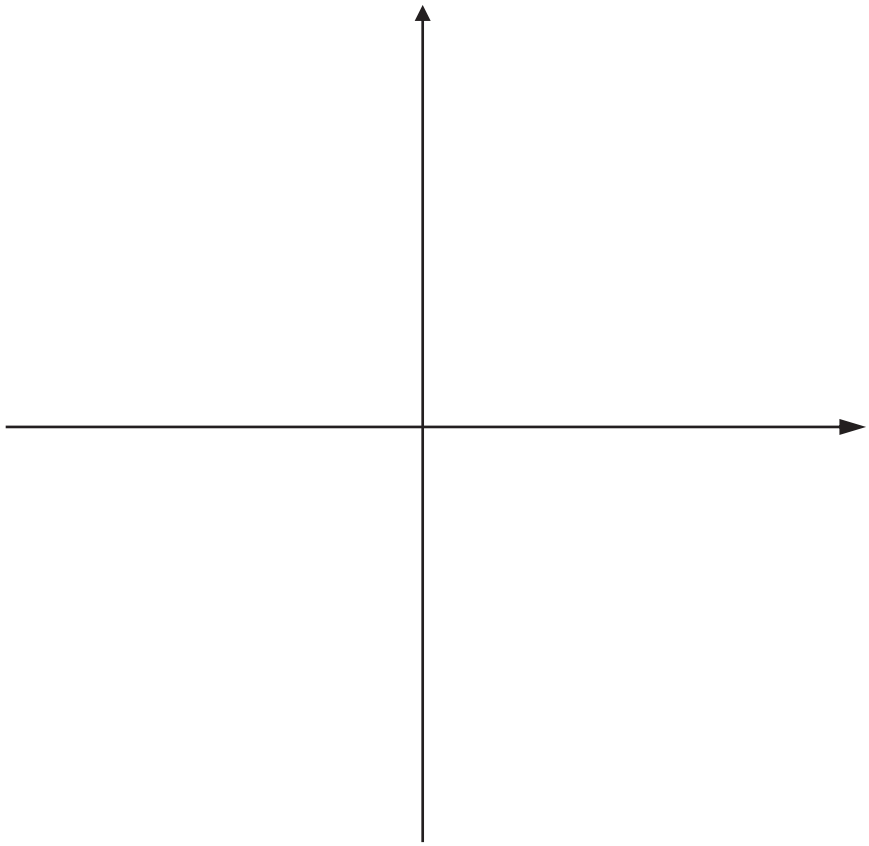
(c) n is a positive integer.
Show that, for all n, $(3n+1)^2-(3n-1)^2$ is a multiple of 4. [2]

12 Sketch the graph of $y=-(x+3)^2+5$ on the axes below.
Indicate clearly the coordinates of the points where the graph crosses the axes and the turning point on the curve. [3]



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13. The sum of the first n terms of a sequence is given by $2n^2 - n$.

Find the 10th term of this sequence.

Answer _____[2]

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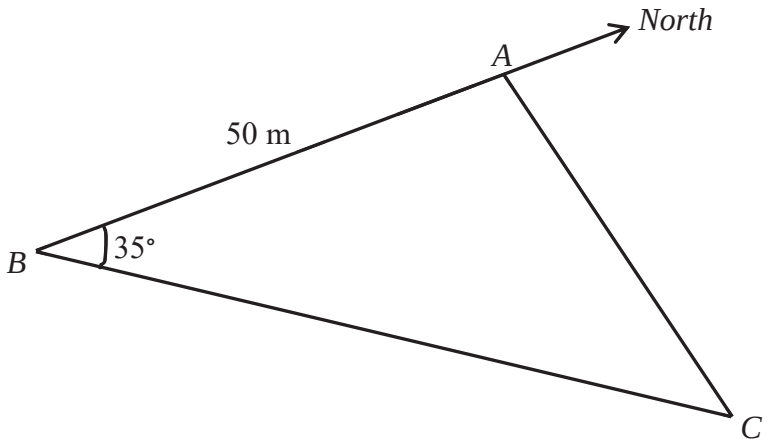
14



The diagram shows the positions of three points, A , B and C. Angle $ABC = 35°$. Point A is due north of point B. The bearing of point C from point A is 80°. AB is 50 m.

(a) Find the bearing of point B from point C.

Answer _____ [1]

(b) Calculate the length AC.

Answer _____ m [2]

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15 Mary weighed 3 pet kittens.
The mean mass of the kittens was 200 grams.
The standard deviation of the masses of the kittens was 10 grams.

The scales used by Mary were found to be inaccurate.
The correct mass of each kitten was 20 grams less than Mary recorded.

(a) Write down the correct value for the mean and standard deviation (SD).

Answer Mean = _____g[1]

SD = _____ g[1]

(b) After a number of years, the mass of each of the 3 kittens are tripled. Calculate the new standard deviation.

Answer SD = _____g[1]

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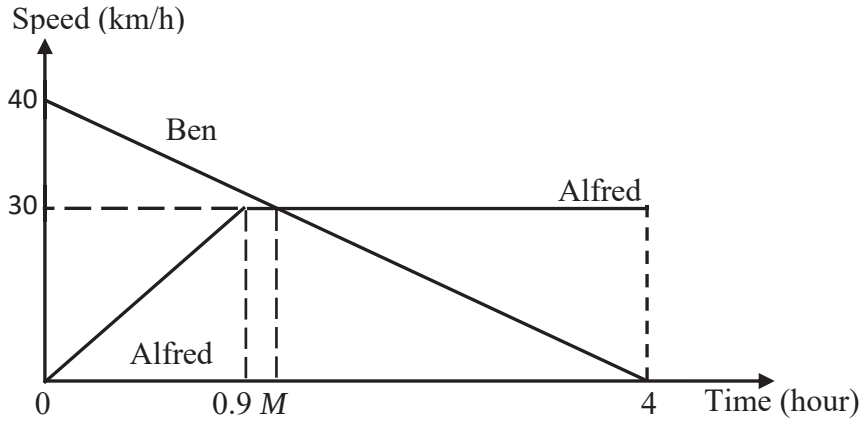
16 The speed-time graph shows the journeys for two drivers, Alfred and Ben. They travelled on the same road. Ben drove past Alfred at the time when Alfred started his journey.



(a) Charles commented that Alfred will meet Ben at time = M hour since the graphs intersect at time = M hours. Is Charles correct ? Explain.

_____

_____

_____

_____[2]

(b) Calculate the value of M.

Answer _____h [2]

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17 $\xi = \{integers\ x:\ 2 \le x < 10\}$

$E = \{even\ numbers\}$

$M = \{multiples\ of\ 3\}$

$F = \{factors\ of\ 48\}$

(a) List the element(s) in

(i) $M \cap E$

Answer _____[1]

(ii) $(M \cup F)'$

Answer _____[2]

18 Cindy deposited $20000 in a bank account which offered an interest of 1.2% per annum compounded monthly. She withdrew her money after 1 year 6 months. Calculate the amount of interest earned.

Answer $ _____[2]

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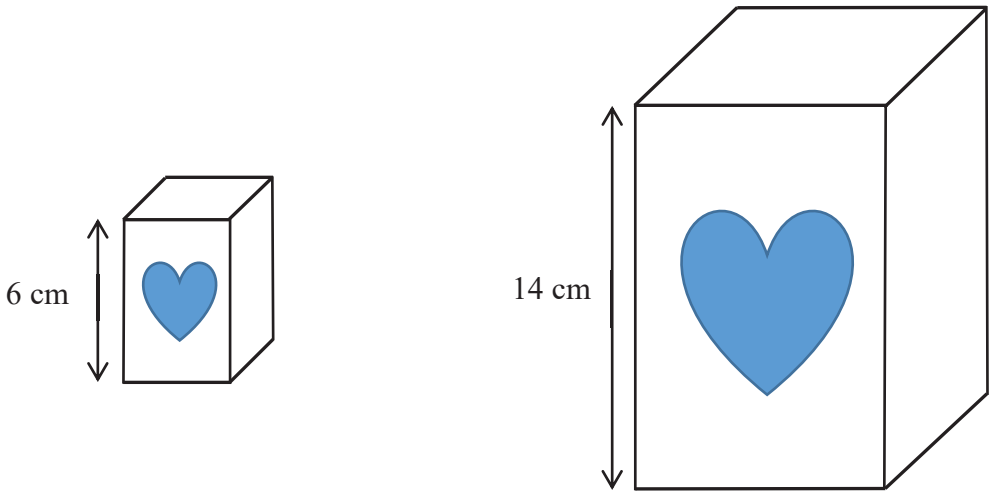
19. The diagram shows two geometrically similar figures made of the same material.
The length of the smaller figure is 6 cm.
The length of the larger figure is 14 cm.



(a) The area of the heart in the larger figure is 15 cm^2.
Calculate the area of the heart in the smaller figure.

Answer_____cm^2 [2]

(b) If the mass of the smaller figure is 200 grams, calculate the mass of the larger figure.

Answer _____g [2]

(c) The smaller figure is sold for \$2.50 while the larger figure is sold for \$ 25.50. Which figure will be a better buy? Explain.

Answer _____[2]

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20 Two cafe outlets, *A* and *B* sells coffee, tea and cakes.
Both outlets charge \$ 2.50 for a cup of tea, \$3.50 for a cup of coffee and \$3.00 for a piece of cake.

(a) On a Saturday, Cafe *A* sells 100 cups of coffee, 70 cups of tea and 50 pieces of cake.
Cafe *B* sells 120 cups of coffee, 90 cups of tea, and 40 pieces of cake.

Represent this information in a 2×3 matrix $\boldsymbol{Q}$.

Answer Q = $\begin{pmatrix} \quad & \quad & \quad \\ \quad & \quad & \quad \end{pmatrix}$ [1]

(b) By multiplying *Q* with another matrix, calculate the total amount collected by each of the two outlets respectively.

Answer: Outlet *A*: \$ _____

Outlet *B*: \$ _____ [2]

(c) Both outlets decided to give a special discount of 20% for coffee, 10% for tea and 10% for cakes.
By the multiplication of two matrices, calculate the new prices of a cup of coffee, of a cup of tea and of a piece of cake.

Answer: New price of a cup of coffee : \$_____,

New price of a cup of tea : \$_____,

New price of a piece of cake : \$_____[2]

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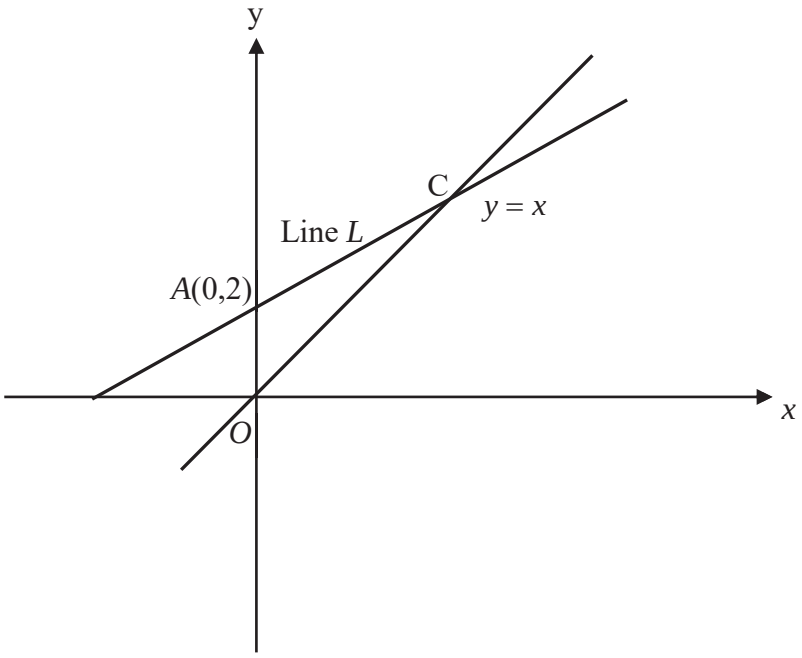
21



The line L passes through the point A (0,2) and meets the line $y = x$ at point C. O is the origin. The area of OAC is 3 units^2.

(a) What is the equation of line L ?

Answer _____[2]

(b) There is a point B such that OC is the line of symmetry of the figure $OACB$.

(i) What is the name of quadrilateral $OACB$?

Answer _____[1]

(ii) State the coordinates of the point B.

Answer B (,) [1]

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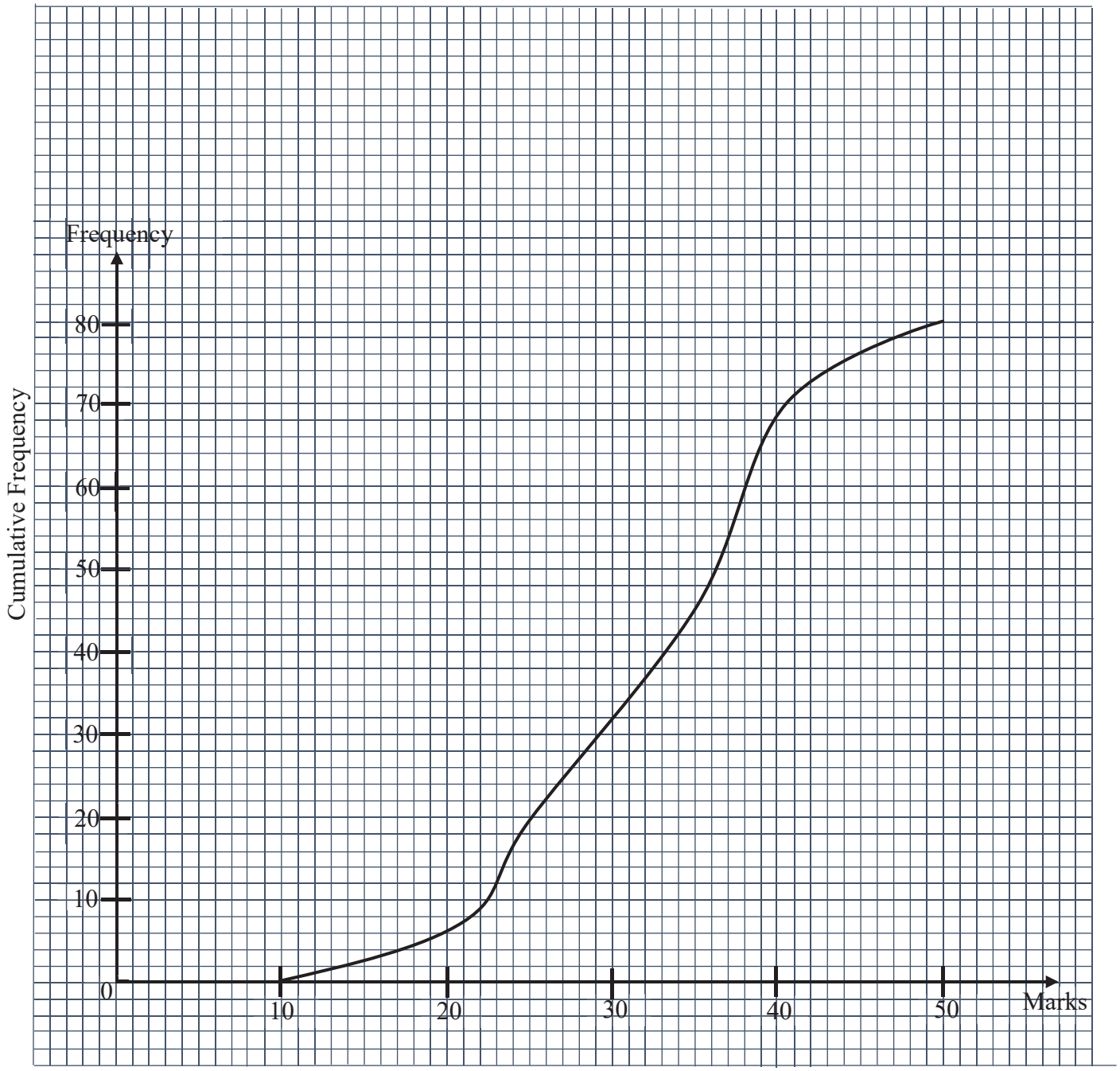
22. The cumulative frequency represents the marks scored by a group of 80 students.



(a) Use the graph to find the number of students with a score of more than 26 marks.

Answer _____ [1]

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(b) Calculate the range of the marks scored.

Answer _____[1]

(c) If another group of 80 students have the same median mark with a smaller interquartile range, how would the cumulative frequency graph of this second group of students differ from this cumulative frequency graph ?

_____

_____ [1]

23 A building is drawn to a scale of 1: n.
The actual area of the building floor is 500 m^2 while the area of the building on the map is 20 cm^2.
Find the value of n.

Answer n = _____[2]

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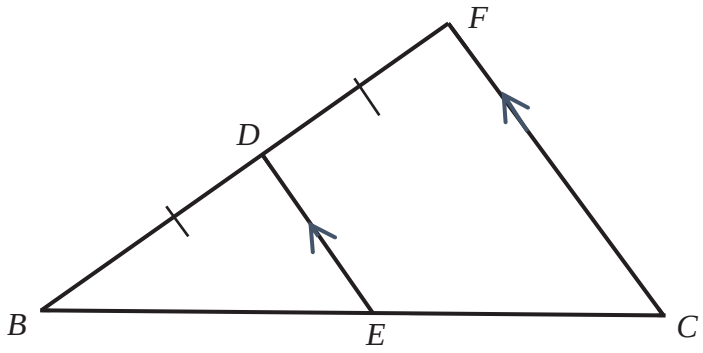
24 In the triangle BFC, D is the mid - point of BF. DE is parallel to FC.



Show that ΔBDE is similar to ΔBFC.

_____

_____

_____

_____

_____

_____[2]

.

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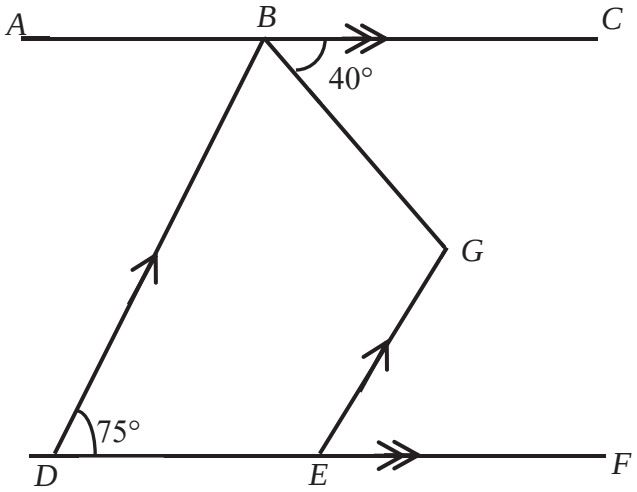
25. In the diagram, the straight line ABC is parallel to the line DEF.
The straight line DB is parallel to the line EG. $\angle BDE = 75°$ and $\angle CBG = 40°$.



Calculate the value of the following angles, stating your reasons clearly.

a. $\angle DBG$

_____

_____

_____

_____[2]

b. $\angle BGE$

_____

_____

_____

_____[1]

26. Explain whether a kite can be a rhombus.

_____

_____

_____

_____[2]

----------END OF PAPER----------

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Name:_____ **Class**_____ **Index No**____

BUKIT PANJANG GOVERNMENT HIGH SCHOOL

PRELIMINARY EXAMINATION 2020

SECONDARY FOUR EXPRESS

SECONDARY FIVE NORMAL ACADEMIC

MATHEMATICS	**4048/2**
Paper 2	Date: 25 August 2020
Candidates answer on the question paper.	Time: 0800 – 1030
Additional materials: Graph paper	Duration: 2h 30 min

READ THESE INSTRUCTIONS FIRST

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At the end of the examination, fasten all your work securely together
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 100.

This paper has a total of 22 pages.

Setter: Chong Lin Lin **[Turn over]**

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Mathematical Formulae

Compound interest

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

Mensuration

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

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

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1 **(a)** Simplify $\frac{2x}{x^0} \div \left(\frac{2y}{x}\right)^{-2}$, leaving your answer in positive indices.

Answer _____ [3]

(b) Express y in terms of p and q, given that $\frac{1}{q} = \frac{2}{y} + p$.

Answer _____ [3]

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2 **(a)** Express $\frac{1}{x-3} - \frac{6}{x^2-9}$ as a single fraction in its simplest form.

Answer _____ [2]

(b) **(i)** Express $y = x^2 + 4x - 5$ in the form $y = (x+a)^2 + b$, where a and b are constants.

Answer _____ [2]

(ii) Write down the equation of the line of symmetry of the graph of $y = x^2 + 4x - 5$.

Answer _____ [1]

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3 The line AB is shown below.

(a) Construct an equilateral triangle ABC. [1]

(b) Construct the perpendicular bisector of AB. [1]

(c) Construct the angle bisector of $\angle CAB$. [1]

(d) Mark clearly a possible point that is inside the triangle, equidistant from AC and AB, and is nearer to A than B. Label this point P. [1]

(e) The point Q is such that $\angle ACQ = 120°$ and $\frac{BQ}{BA} = 0.9$.

Find two possible positions of Q. Label these point Q_1 and Q_2.

Measure and write down the length AQ (where Q can be any of the two points).

Answer _____ cm [3]

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4 The exterior angle of a regular n-sided polygon is 14° more than the exterior angle of a regular $(2n + 6)$-sided polygon.

(a) Write down and simplify an expression, in terms of n, each exterior angle of the $(2n + 6)$-sided polygon.

Answer _____ ° [1]

(b) Write down an equation in n and show that it reduces to $14n^2 - 138n - 1080 = 0$.

[3]

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(c) Solve the equation $14n^2 - 138n - 1080 = 0$.

Answer _____ [2]

(d) Explain why one of the solutions above is rejected.

Answer

[1]

(e) Hence, find the value of each interior angle of the n-sided polygon.

Answer _____ ° [2]

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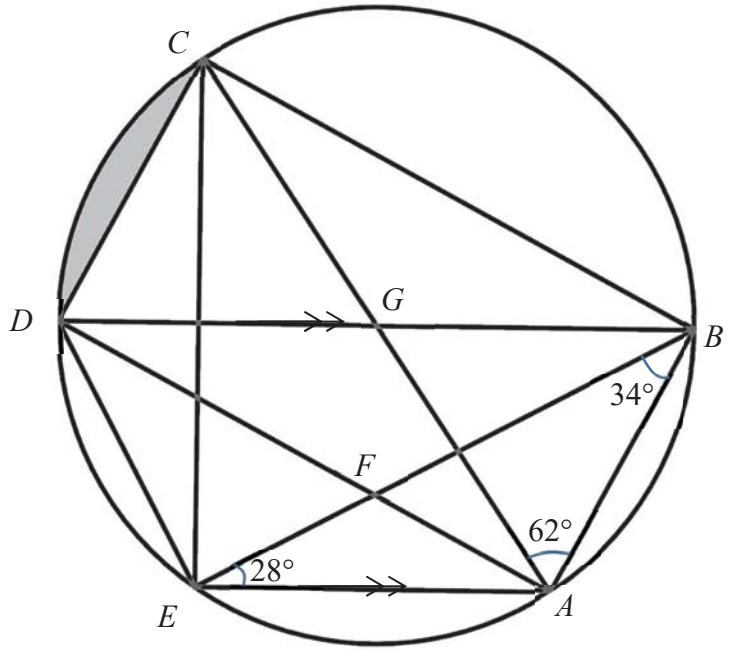
5 The points A, B, C, D and E lie on the circle. $\angle AEB = 28^\circ$, $\angle CAB = 62^\circ$ and $\angle ABE = 34^\circ$. AE is parallel to BD.



(a) Find two other angles that are 62°, stating the angle property.

Answer _____ [2]

(b) Explain whether AC is the diameter of the circle.

Answer

[2]

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(c) Find the following angles, stating all the angle properties.

(i) $\angle EBD$

(ii) $\angle DEA$

Answer **(i)** _____ °

(ii) _____ ° [3]

(d) Explain why G is the center of the circle.

Answer

[2]

(e) If the radius of the circle is 7 cm, find the area of the shaded region.

Answer _____ cm^2 [3]

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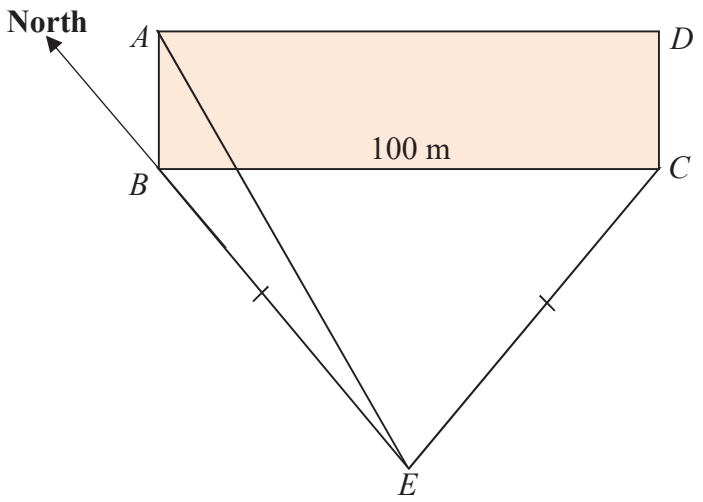
6 In the diagram, *ABCD* represents a vertical cliff face. The bottom of the cliff, *BC,* is 100 m and is at sea level. A boat is in the sea at *E*.

B is due north of *E* and the bearing of *C* from *E* is 070°.

E is known to be equidistant from *B* and *C*.



(a) Find the bearing of *C* from *B*.

Answer _____ ° [2]

(b) Show that $BE = 87.17$ m.

Answer

[2]

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(c) Find the area of ΔBCE, leaving your answer to the nearest square metre.

Answer _____ m^2 [2]

(d) It is given that the angle of depression of E from A is 20.2°. Find the height of the cliff BA, leaving your answers in 3 significant figures.

Answer _____ m [2]

(e) P is a point on BC such that $\dfrac{Area\ of\ \Delta BEP}{Area\ of\ \Delta CEP} = \dfrac{3}{2}$.

Find the length of CP.

Answer _____ m [2]

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7 Part of a pattern of numbers is shown in the table below.

		C_1	C_2	C_3	C_4	C_5	C_6
Row	1	2	3	4	5	6	7
Row	2	8	9	10	11	12	13
Row	3	14	15	16	17	18	19
Row	4	20	21	22	23	24	25
Row	5	26	27	28	29	30	31
*	*	*	*	*	*		
*	*	*	*	*	*		
Row	n		x	y			
Row	$n+1$		s	t			

(a) Express y, s and t in terms of x.

Answer $y =$

$s =$

$t =$ [2]

(b) Show that the difference between xt and ys is always 6.

Answer

[2]

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(c) Express x in terms of n.

Answer $x =$ _____ [1]

(d) Explain why xy would be in column number C_5, for any value of n.

Answer _____ [2]

(e) From the above, which column would ys lies in (C_1, C_2, C_3, C_4, C_5 or C_6)?

Answer _____ [1]

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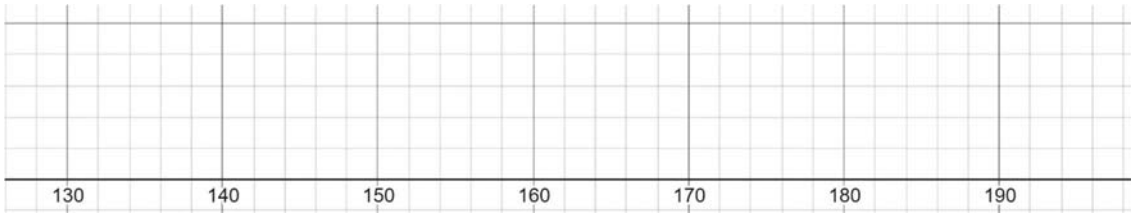
8 The ordered stem-and-leaf diagram records the height of 21 plants in Plantation *A*.

Stem	Leaf							
13	0	7	8	9	9			
14	1	1	2	6	7	8	9	9
15	0	2	3	5	6	8	8	8

Key: 14 | 8 means 148 cm

(a) Represent the above information in a box and whisker.

Answer



[3]

(b) State the modal height.

Answer _____ cm [1]

(c) Calculate the percentage of plants having a height of less than 150 cm.

Answer _____ % [1]

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(d) Two plants are selected at random from Plantation A.

The students are asked to calculate the probability of selecting a plant that is less than 150 cm and another plant that is at least 150 cm.

(i) Alice says that the above probability is calculated using $\frac{8}{21}$ and $\frac{13}{21}$.

Explain why she is wrong.

Answer

[1]

(ii) Calculate the above-mentioned probability.

Answer _____ [2]

(e) 30 plants are planted in Plantation B on the same day. The range of height is 24 cm, the interquartile range is 10 cm and the median is 152 cm. Compare the height in Plantation A and B in two ways.

Answer

[2]

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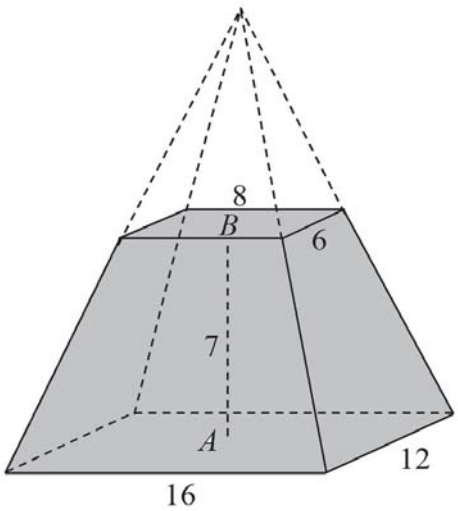
9 The frustum shown in the diagram is a metal solid obtained by cutting off the top part of a pyramid horizontally.

The dimension of the top rectangular plane is 8 cm by 6 cm.

The dimension of the bottom rectangular plane is 16 cm by 12 cm.

The height, AB, of the frustum is 7 cm where A is the center of the base.



(a) Explain why the height of the pyramid that is cut off is 7 cm.

Answer

[2]

(b) Show that the volume of the frustum is 784 cm^3.

Answer

[2]

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(c) Assuming negligible loss in the process of melting, how many spherical balls (of radius 2 cm) can be formed if the frustrum is melted?

Answer _____ [2]

(d) 3 of the above frustums are to be packed into a rectangular box. To save cost, the seller should keep the amount of material of the rectangular box to the minimum.

Albert claims that the dimension should be 30 cm by 16 cm by 7cm (Box *A*).
Betty claims that the dimension should be 38 cm by 12 cm by 7cm (Box *B*).
Carol claims that the dimension should be 21cm by 16 cm by 12cm (Box *C*).

(i) Explain which box will be too small.

Answer

[1]

(ii) Which of the other two boxes would use the minimum amount of material?

Answer _____ [3]

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10 A group of researchers brought 180 koalas to an island and tracked the number of koalas over a few years.

x (years)	0	0.5	1	2	3	4	5	6	6.5	7	7.5
y (no of animals)	180	177	175	172	p	172	175	180	183	187	191

(a) Using a scale of 2 cm on both axes to represent 1 year on the x-axis and 2 animals on the y-axis for $170 \le y \le 192$, plot the values given and join them with a smooth curve.

[3]

(b) Use your curve to estimate the value of p, corrected to nearest integer.

Answer _____ [1]

(c) By drawing a tangent, find the gradient at $x = 6$.

Answer _____ [2]

(d) The number of koalas (y) turns out to be related to an unknown quadratic function $y = (x + a)^2 + b$. Find the value of a and of b.

Answer $a =$ _____ $b =$ _____ [2]

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(e) The researchers also brought 180 penguins to the same island and noticed that the number of penguins increased at a steady rate of 1 per year.

(i) Write down an equation connecting the number of penguins, y, and the number of years, x.

Answer _____ [1]

(ii) On the same graph in **(a)**, draw the graph of the equation in **(e)(i)** and state the point of intersection (x, y).

Answer _____ [2]

(iii) What would this point of intersection represent in this research?

Answer

[1]

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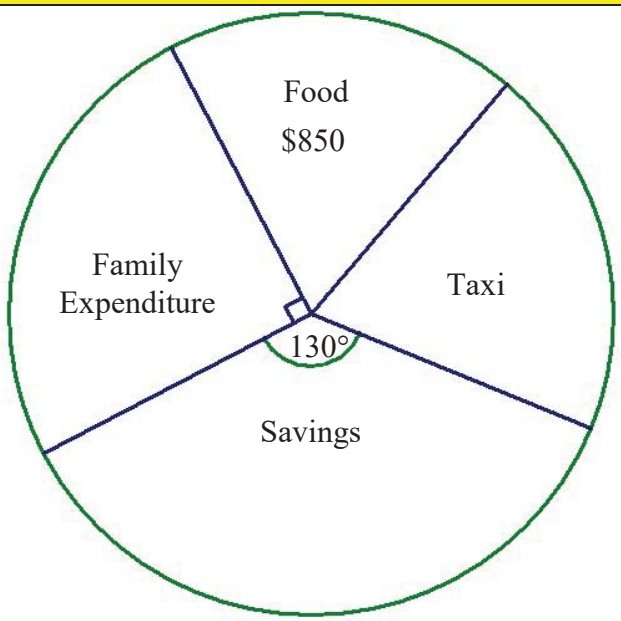
11 Charlotte takes the taxi every day. She is thinking of buying a car and wants to pay off the car loan as soon as possible. The tables below give the information Charlotte can use.

Charlotte's financial situation	
Money set aside to buy a car	\$50000
Monthly salary	\$4500

Information on the car and car loan	
Car Price	\$96000 Customer must take a minimum loan of 50% from the car dealer.
Loan Period (Number of years, x)	• $2 \leq x \leq 7$, x is an integer • Customer needs to decide on the loan period on the day he or she buys the car.
Interest rate of loan	2.45% per annum simple interest

Information on how Charlotte uses her monthly salary



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(a) Determine the minimum loan amount.

Answer $ _____ [1]

(b) Charlotte calculated that if the loan period is 2 years and that she took a loan of $48000, her monthly car instalment will be $2098.00. Show that Charlotte is correct.

Answer

[2]

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(c) Charlotte intends to use **no more than** her current taxi expenditure to pay for her monthly car instalment. Suggest the minimum loan period. Justify your answer with clear workings.

Answer _____ [7]

(d) Give a possible reason to explain why Charlotte's savings will be reduced even if her monthly instalment is the same as the current taxi expenditure.

Answer

[1]

End of paper

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