Candidate's Name _____**Class** _____**Index No**____

BUKIT PANJANG GOVERNMENT HIGH SCHOOL
PRELIMINARY EXAMINATION 2018
SEC FOUR EXPRESS / FIVE NORMAL

MATHEMATICS **4048 / 01**

Paper 1 **Date: 15 Aug 2018**

Duration: 2 hours

Time: 0745 - 0945

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, 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.

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.

FOR EXAMINER'S USE
/ 80

This document consists of 18 printed pages.

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

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Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

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

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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) Factorise $9x^2 - 12xy + 4y^2$.
   (b) Hence, for $9x^2 - 12xy + 4y^2 = 0$, find the ratio $x : y$.

Answer (1a) _____[2]

(1b) _____[1]

2. Red paint was mixed with blue paint in different combinations in an attempt to obtain purple paint. The table shows the combinations of red paint and blue paint.

Red paint (litres)	1	2	3	4
Blue paint (litres)	3	5	7	9

State and explain your answer, whether the amount of red paint used is proportional to the amount of blue paint used for the combinations.

Answer (2) _____[1]

3. A group of students line up. If they lined up in 2s or 6s or 9s, there will be one student without a partner. Calculate the least number of students in the contingent.

Answer (3) _____[2]

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4. Arthur, Clement and John are to share a bag of sweets amongst themselves in the ratio 2: 3: 4 John obtained 6 sweets more than Arthur, Find

(a) the total number of sweets received by Arthur,
(b) the number of sweets received by Clement.

Answer (4a) _____[2]

(4b) _____[1]

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5. The rectangular floor of a room measuring 456 m by 696 m is to be laid with square tiles.

(a) Calculate the highest common factor of 456 and 696.
(b) Hence, or otherwise, find the least number of identical square tiles that is required to cover the floor.

Answer (5a) _____[1]

(5b) _____[2]

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6. The table below shows the number of boys and girls in a class with their dietary preferences.

NUMBER OF			
BOYS WHO PREFER		GIRLS WHO PREFER	
CHILI	TOMATO SAUCE	CHILI	TOMATO SAUCE
12	8	10	10

(a) A pupil is selected at random from the class. Calculate the probability that the pupil
(i) is a boy who prefers chili,
(ii) is a girl.

(b) Two pupils are selected at random from the class. Calculate the probability that
(i) both are boys,
(ii) neither is a girl who prefers tomato sauce.

Answer (6ai) _____[1]

(6aii) _____[1]

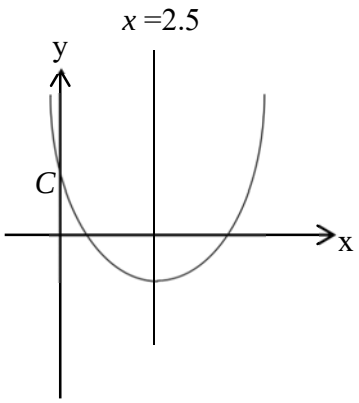
(6bi) _____[2]

(6bii) _____ [2]

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7. The diagram shows the graph of $y = x^2 + bx + c$. The line of symmetry is $x = 2.5$. The graph cuts the y- axis at $C(0,4)$. Calculate the value of

(a) b,
(b) c,
(c) the minimum y – value of the graph.



Answer (7a) _____[2]

(7b) _____[1]

(7c) _____[1]

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8. Simplify $(4h^{\frac{1}{2}} + 2k^{\frac{3}{2}})(4h^{\frac{1}{2}} - 2k^{\frac{3}{2}})$

Answer (8) _____ _[2]

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9. Consider the sequence 2, 5, 8, 11, …… .

(a) State the
(i) 6^{th} term of the sequence,
(ii) n^{th} term of the sequence.

(b) If the p^{th} term of the sequence is 56, find the value of p.

Answer (9ai) _____[1]

(9aii) _____[1]

(9b) _____[1]

10. Given that x and y are integers such that $-2 \leq x \leq 5$ and $3 \leq y \leq 8$, find the

(a) greatest value of $x^2 - y^2$,
(b) smallest value of $\frac{y+x}{x}$.

Answer (10a) _____[2]

(10b) _____[2]

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11. p is directly proportional to q^2.
If q is decreased by 75 %, find the percentage decrease in p.

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Answer (11) _____[2]

12. Adrian, Belle and Cindy were having a conversation, when Denzyl comes along. Commenting on a statistical finding that 1 in 4 Singaporeans in their 50s suffer from disease *X*, Adrian said," Since all of us are in our 50s and the 3 of us do not have disease *X*, Denzyl must be suffering from disease *X*." State with reason as to whether Adrian was right in his conclusion.

Answer (12) _____

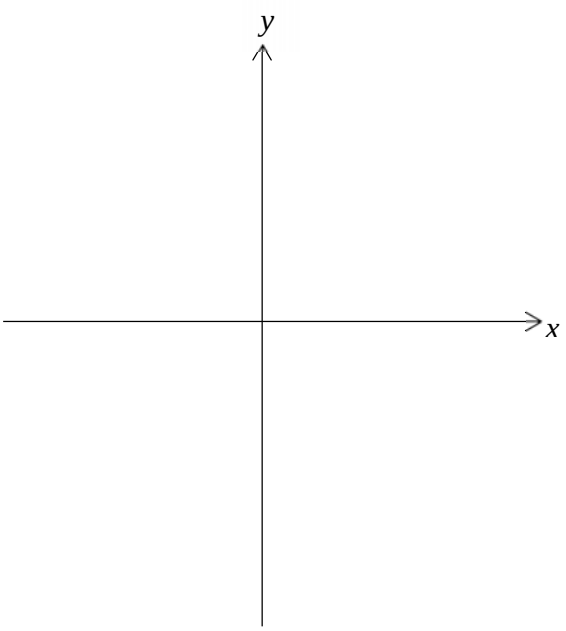
_____

_____[2]

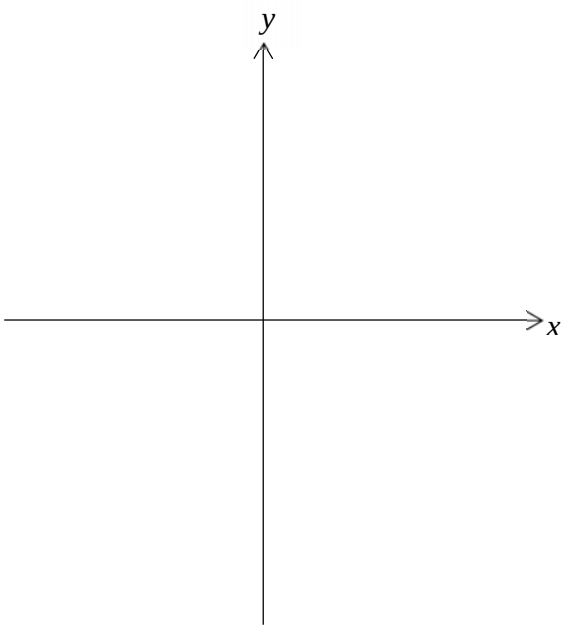
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13. Sketch the graphs of

(a) $y = -\frac{1}{x} + 2$ [1]



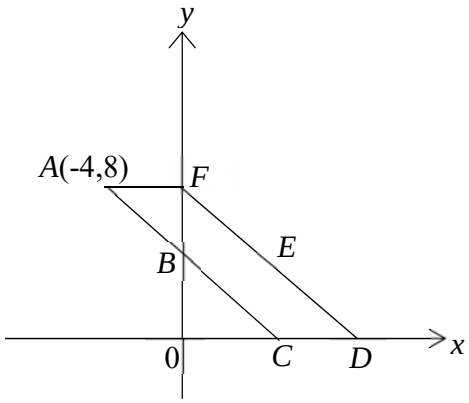
(b) $y = x^3 + 3$ [1]



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14. *ABC* is a straight line. Point *B* (on the y – axis) bisects line *AC*. Point *C* lies on the *x*-axis. *FED* is a straight line having the same length as *AC* and is parallel to *AC*. *E* is the mid-point of *FD*.

(Not drawn to scale)



(a) Show that point *C* has coordinates (4,0).

(b) State the coordinates of point *B*.

(c) Show that $\overrightarrow{FD} = \begin{pmatrix} 8 \\ -8 \end{pmatrix}$.

(d) Hence, or otherwise, calculate the column vector $\overrightarrow{OE}$.

(e) Calculate area of parallelogram *ACDF*.

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Answer (14a) _____[2]

(14b) _____[1]

(14c) _____[1]

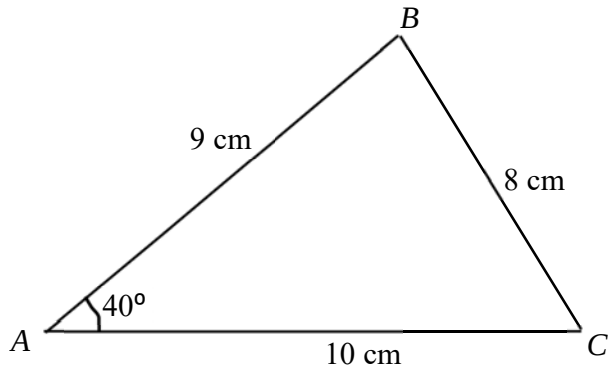
(14d) _____ [1]

(14e) _____ [1]

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15. May set a mathematics question to test her classmates.

Calculate the area of triangle *ABC*.



(a) Describe and explain what is wrong with the question.

(b) Based on your identified error, calculate the
(i) correct area of triangle *ABC*,
(ii) shortest distance from point A to the line *BC*.

Answer (15a) _____[2]

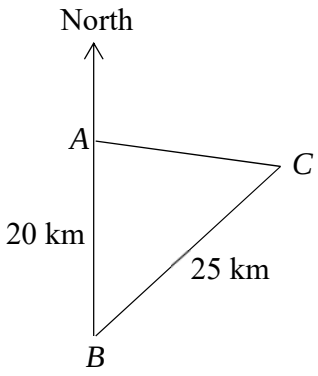
(15bi) _____[1]

(15bii) _____[1]

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16. The points *A*, *B* and *C* rest on level ground. Point *A* lies 20 km to the north of point *B*. Point *C* is at a bearing of 100^0 from point *A*. *BC* is 25 km.

(a) Calculate $\angle ACB$.
(b) Calculate the bearing of *C* from *B*.



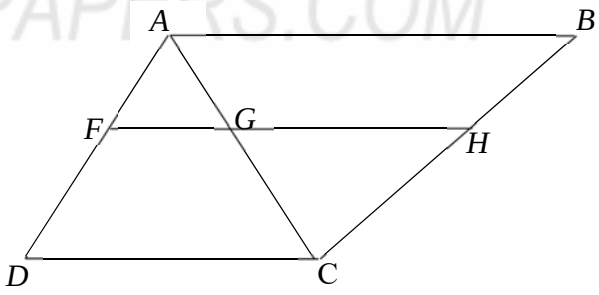
Answer (16a) _____[2]

(16b)_____[1]

17. In the diagram, *ABCD* is a trapezium, where *AB* is parallel to *CD*. *FGH* is a straight line where *FH* is parallel to *AB*. *Given 3AF = 2FD*, calculate the ratio of

(a) *FG : DC* ,
(b) *GH : AB* .

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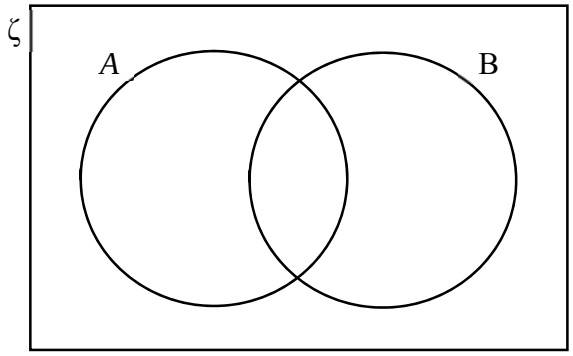
Answer (17a) _____[1]

(17b) _____[2]

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18. $\zeta = \{x : x \text{ is an integer and } 3 < x \leq 15\}$
$A = \{x : x \text{ is a multiple of } 5\}$
$B = \{x : x \text{ is a multiple of } 3\}$

(a) List the elements of A.
(b) Fill in the members of ζ, A and B in the spaces in the Venn diagram below.
(c) List all possible subsets of A.



[2]

Answer (18a) _____[1]

(18c) _____[2]

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19. The table below shows the number of fishes kept by students.

Number of fishes	0	1	2	3	4
Number of students	10	12	x	2	3

(a) If the mean is 1.25, find the value of x.
(b) If the median is 1, find the possible range of values of x.
(c) If the mode is 1, find the highest possible value of x.

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Answer (19a) _____[2]

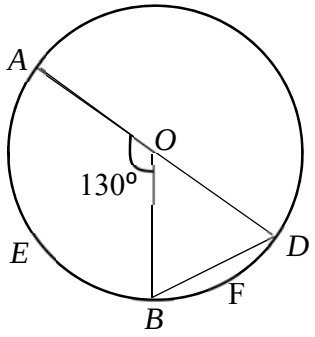
(19b) _____[2]

(19c) _____ [1]

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20. The diagram shows a circle with centre O. AD is the diameter of circle.
If radius OA is 5 cm, and $\angle AOB = 130^{\circ}$, calculate the

(a) area of ***major*** sector AOB,
(b) arc length AEB,
(c) angle OBD,
(d) area of minor segment BDF.



Answer (20a) _____ [1]

(20b) _____ [1]

(20c) _____ [1]

(20d) _____[2]

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21. Three points P, Q and R lie on the circumference of a circle.

(a) Draw the perpendicular bisectors of PR and QR. [1]

(b) Label the intersection of these two perpendicular bisectors as X. Using X as the centre and XP as the radius, draw a circle to pass through P, Q and R. [1]

P

Q

R

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(c) Complete the sentence. X is eqiuidistant from _____ , _____ and _____. [2]

(d) Measure the radius of the circle.

Answer (21d) _____[1]

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22. The position vector of P, relative to O, is $\overrightarrow{OP} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and the coordinates of Q are $(5, -10)$.

a. Find the coordinates of R such that $\overrightarrow{OR} = 3\overrightarrow{OP} + \overrightarrow{OQ}$.

b. Given that M is the midpoint of PQ, express $\overrightarrow{OM}$ as a column vector.

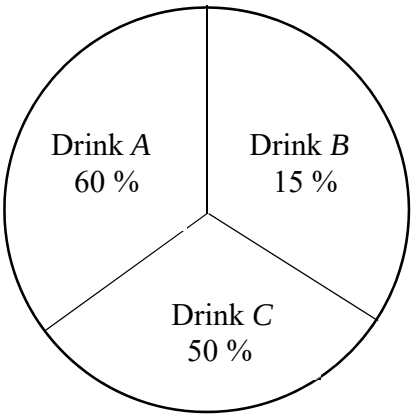
Answer (22a) _____ [1]

(22b) _____ [2]

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23. During a vote for the favorite drink sold in the canteen, a pie – chart was displayed to show the percentage of votes for each of the 3 drinks. State two reasons why the pie-chart is misleading.

State two reasons why the pie-chart is misleading.



Answer (23a)_____

_____

_____[1]

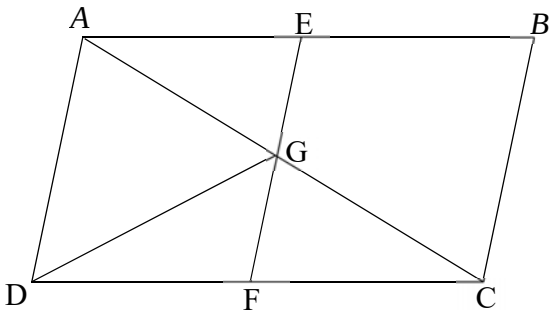
(23b) _____

_____

_____ [1]

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24. In the diagram, ABCD is a parallelogram. *AG* : *GC* is 1:1. *EF*, *BC* and *AD* are parallel to each other. Is triangle *DGF* congruent to triangle *CGF* ? Explain.



Answer (24) _____

_____

_____[2]

END OF PAPER 1

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2018 ELEMENTARY MATHEMATICS PRELIMINARY EXAMINATIONS PAPER 1 ANSWERS

1. (a) $(3x-2y)^2$ (b) $x:y=2:3$

2. No, as the quotients of red paint to blue paint are not constant or equal for each and every quotient.

3. Least number of students in the contingent is 18 + 1 = 19.

4. (a) 6 sweets. (b) 9 sweets.

5. (a) $HCF = 24$ (b) 51

6. (ai) $\frac{3}{10}$ (aii) $\frac{1}{2}$

   (bi) $\frac{19}{78}$ (bii) $\frac{29}{52}$

7. (a) $b=-5$ (b) $c=4$ (c) -2.25

8. $16h-4k^3$

9. (ai) 17
   (aii) $3n-1$
   (b) $p=19$

10. (a) 16
    (b) -7

11. Percentage decrease in P $= 93.75\%$

12. No, The probability figure of ¼ is for a much larger sample size.

14. (a) $\frac{GB}{XC}=\frac{1}{2}$

    $XC = 8\ units$
    x-coordinates of C = -4 + 8
    = 4 units
    C (4.0)

    (b) B (0,4)
    (c) $\overrightarrow{FD}=\begin{pmatrix}8\\-8\end{pmatrix}$
    (d) $\overrightarrow{OE}=\begin{pmatrix}4\\4\end{pmatrix}$
    (e) Area = 32 units^2.

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15.(a) Assuming angle $BAC = 40^{\circ}$, $BC = \sqrt{9^2 + 10^2 - 2(9)(10)cos40^0}$
$= 6.57$ cm

But question stated that $BC = 8$ cm.

OR: Assuming BC = 8 cm,
$8^2 = 9^2 + 10^2 - 2(9)(10)cosA$
Angle $BAC = 49.5^{\circ}$, but Angle $BAC = 40^{\circ}$ in question.

(bi) Assuming angle BAC = 40°, area = $\frac{1}{2}(9)(10)sin40^0 = 28.9\ cm^2$

OR: Assuming Angle BAC = 49.4584°, Area = $\frac{1}{2}(9)(10)sin49.4584^0$ = 34.2 cm^2

bii) $\frac{1}{2}(8)h = 34.19704$
h = 8.55 cm

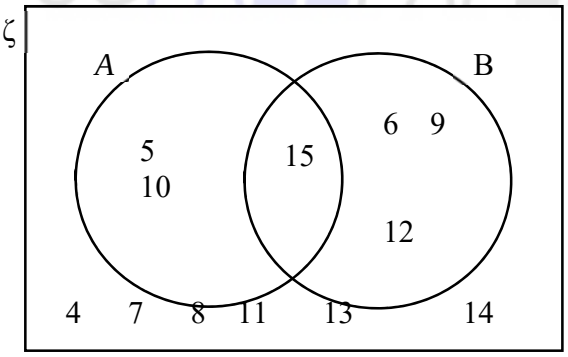
OR: $\frac{1}{2}(6.56597)h=28.92544$
H = 8.81 cm

16. (a) Angle $ACB = 52.0^{\circ}$
(b) Bearing is 048.0°

17. (a) $FG : DC = 2: 5$

(b) $GH : AB = 3: 5$

18. (b)



(a) 5, 10, 15

(c) {5}, {10}, {15}, {5,10}, {5,15}, {10,15}, {5,10,15}, { }

19. (a) $x = 5$
(b) $0 \leq x \leq 17$
(c) 11.

20.
(a) Area = 50.2 cm^2
(b) Arc length = 11.3 cm
(c) Angle $OBD = 65^{\circ}$
(d) Area = 1.33 cm^2.

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21. (c) P, Q and R
(d) 3.0 cm

22. (a) *R* (14,4)

(b) $\overrightarrow{OM} = \begin{pmatrix} 4 \\ -4 \end{pmatrix}$

23a The sum of percentages is 125 % which is not equal to 100 %.

23b. The percentages for each of the 3 drinks are not in proportion to the percentage of area of circle

24. *GF* is common,
DF = CF,
but there is no information to suggest *DG = CG* thus *SSS property for congruency*
angle *GFC* = angle *GFD thus* SAS property for congruency.

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Candidate's Name: _____Class_____ Index No____

BUKIT PANJANG GOVERNMENT HIGH SCHOOL

Preliminary Examination 2018

SECONDARY 5 (NORMAL(ACADEMIC))

SECONDARY 4 (EXPRESS STREAM)

MATHEMATICS

Paper 2

4048/02

Date: 14 August, 2018
Duration: 2h 30 min
Time: 0745 – 1015 h

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.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the questions.
At the end of the examination, fasten all your work securely together.

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If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

Calculators should be used 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.

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 consists of 13 printed pages.

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Mathematical Formulae

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

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

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Answer **all** the questions.

1. (a) Given that $m = 2k\sqrt{\frac{n-5}{3+n}}$, express n in terms of k and m. [3]

   (b) Express $1 + \frac{8}{x^2-9} - \frac{1}{3-x}$ as a single fraction in its lowest term. [3]

   (c) Given that $4^{k-1} = 2\sqrt{8^k}$, determine the value of k. [3]

2. A pond is filled up with 60 m^3 of water. There are two pumps, *A* and *B* which can be used to drain the pond. Pump *A* can drain the water at a rate of x m^3 per minute, while Pump *B* can drain the water at a rate of $(x + 0.3)$ m^3 per minute.

   (a) (i) Write down the time taken, in minutes, for Pump *A* to drain out all the water from the pond completely. [1]

   (ii) Write down the time taken, in minutes, for Pump *B* to drain out all the water from the pond completely. [1]

   (b) Given that Pump *A* takes 3 minutes and 20 seconds more than Pump *B*, form an equation in x and show that it reduces to $10x^2 + 3x - 54 = 0$. [3]

   (c) Solve the equation, $10x^2 + 3x - 54 = 0$ and hence write down the time taken in minutes for Pump *A* to drain out all the water from the pond completely. [3]

   (d) If both pumps are turned on together, will the pumps be able to drain out all the water completely within 12 minutes? Explain your answer. [2]

3. The first three terms in a sequence of numbers, T_1, T_2, T_3, …, are given below.

$$T_1 = 3^0 + 1 + 2^2 = 6$$
$$T_2 = 3^1 + 4 + 3^2 = 16$$
$$T_3 = 3^2 + 7 + 4^2 = 32$$

   (a) Find T_4. [1]

   (b) Find an expression, in terms of n, for the nth term, T_n of the sequence. [3]

   (c) Consider the following sequence.

$$S_1 = -T_1$$
$$S_2 = T_2$$
$$S_3 = -T_3$$

   Using your answer from (b), find an expression for the n^{th} term, S_n of the sequence. [1]

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4. **Answer the whole of this question on a sheet of graph paper.**

A manufacturer makes a profit of $\$y$ for x toys sold, where

$$y = 250 - \frac{4800}{x} - \frac{x}{2}.$$

Some corresponding values of x and y are given in the table below.

$\boldsymbol{x}$	10	30	40	50	100	150	200	250	300
$\boldsymbol{y}$	–235	75	110	129	152	$\boldsymbol{p}$	126	105	84

(a) (i) Find the value of $\boldsymbol{p}$. [1]

(ii) Using a scale of 2 cm to represent 50 toys, draw a horizontal x-axis for $0 \leq x \leq 300$.

Using a scale of 2 cm to represent \$50, draw a vertical y-axis for $-250 \leq y \leq 200$.

On your axes, plot the points given in the table and join them in a smooth curve. [3]

(b) Use your graph to find the

(i) number of toys the manufacturer needs to sell so as to break even, [1]

(ii) maximum profit earned by the toy manufacturer and the corresponding number of toys sold. [2]

(c) (i) By drawing a tangent, find the gradient of the curve at the point where $x = 160$. [2]

(ii) Describe briefly what your answer in (c)(i) represents. [1]

(d) By drawing a suitable straight line on the same axes, solve the equation [3]

$$\frac{x}{2} + \frac{4800}{x} - 250 + 100 = 0$$

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5. A confectionary shop sells 2 different gift hampers, *Deluxe* and *Premiere*, each comprising of chocolate bars, bags of candy and packets of biscuits. The contents of each box are as shown below.

Gift Box	Number of chocolate bars	Number of bags of candy	Number of packets of biscuits
Deluxe	3	5	2
Premiere	5	4	3

The above information can be represented by the matrix $\boldsymbol{P} = \begin{pmatrix} 3 & 5 & 2 \\ 5 & 4 & 3 \end{pmatrix}$.

The cost price and the selling price of each item are as shown.

	Cost price	Selling price
Chocolate bar	\$3	\$4
Bag of candy	\$2.80	\$4.20
Packet of biscuits	\$2	\$3.80

(a) (i) A customer, Mr Lee bought 12 *Deluxe* hampers and 20 *Premiere* hampers.
Given that $\boldsymbol{R} = (12 \quad 20)$, find the matrix $\boldsymbol{S}$ if $\boldsymbol{S} = \boldsymbol{RP}$. [2]

(ii) Describe what is represented by the elements of $\boldsymbol{S}$. [1]

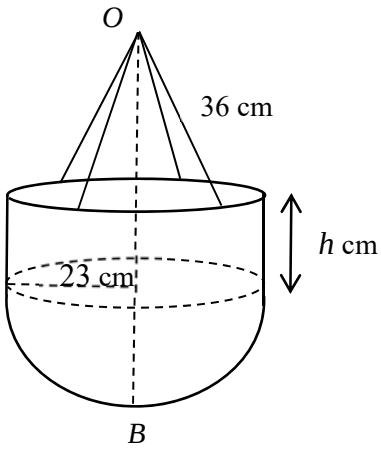
(b) Using matrix multiplication, evaluate matrix $\boldsymbol{Q}$ such that the elements of $\boldsymbol{Q}$ informs the the confectionary shop owner of the total cost price and the total selling price respectively. [3]

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(c) Given that $\boldsymbol{X} = \begin{pmatrix} \boldsymbol{a} \\ \boldsymbol{b} \end{pmatrix}$ and $\boldsymbol{QX}$ gives the profit made, state the value of $\boldsymbol{a}$ and $\boldsymbol{b}$, and hence find the total profit. [2]

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6. (a) The diagram below shows a container which is made by attaching an open hemisphere of internal radius 23 cm to the rim of a hollow cylinder with the same internal radius and a height of h cm.



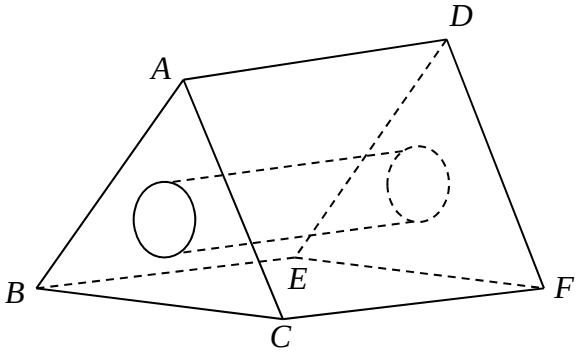
The container is suspended from O by four wires, each of length 36 cm, fastened symmetrically to the rim of the cylinder.

It is given that 43.7 litres of water is needed to completely fill the container.

(i) Show that $h = 10.96$ cm, corrected to 4 significant figures. [2]

(ii) Hence, find the vertical distance OB. [2]

(b) The figure below shows a solid triangular prism where the cross section ABC and DEF are equilateral triangles. It has a cylindrical hole in the centre and a square base $BCFE$ of area 36 m^2. The volume of the cylindrical hole is 75.36 m^3.

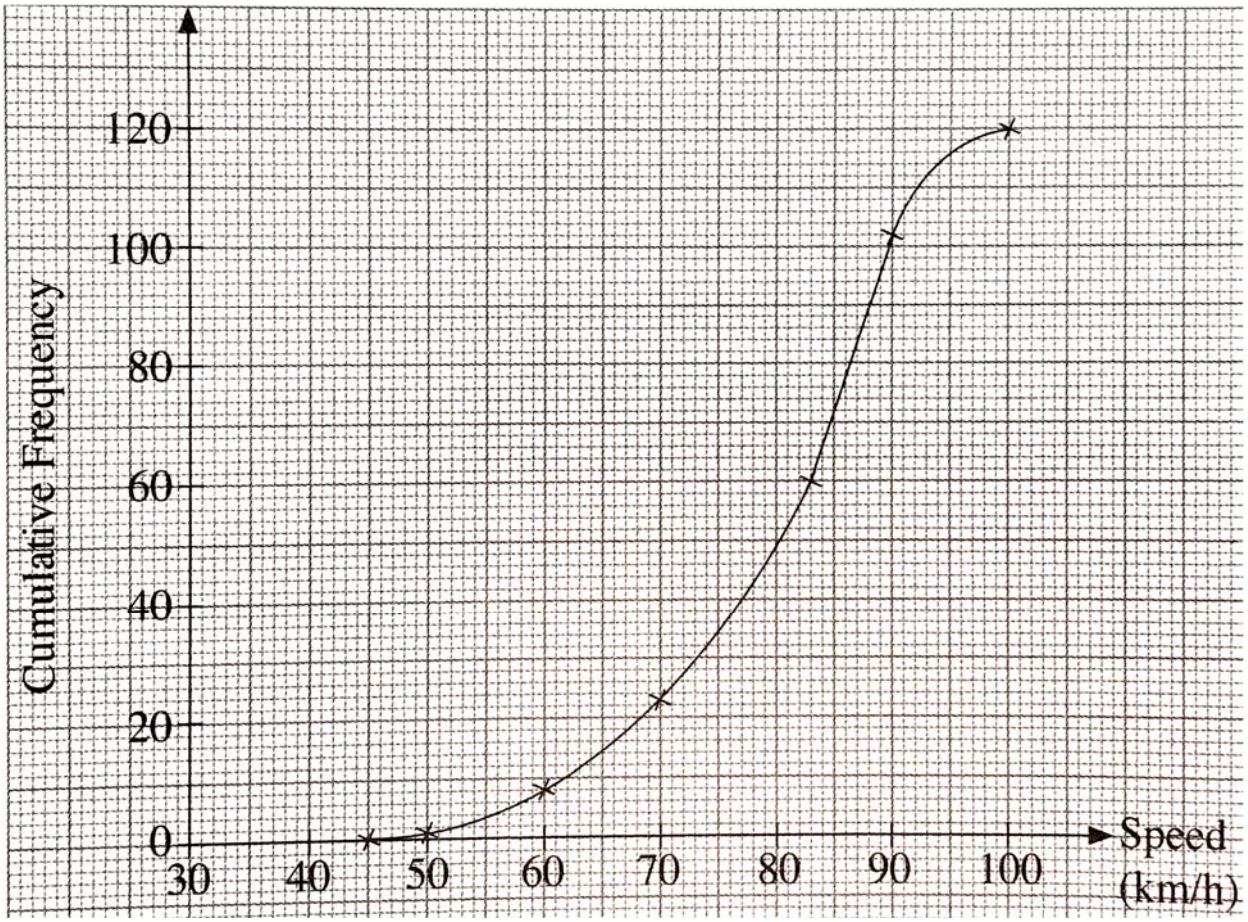


1 can of paint covers 9 m^2 of the area. Find the number of cans of paint to purchase in order to paint the entire solid.

[5]

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7. The diagram below shows the cumulative frequency curve of the speed of 120 cars passing through a certain point along an expressway at 11 am.



(a) Use the graph to find,

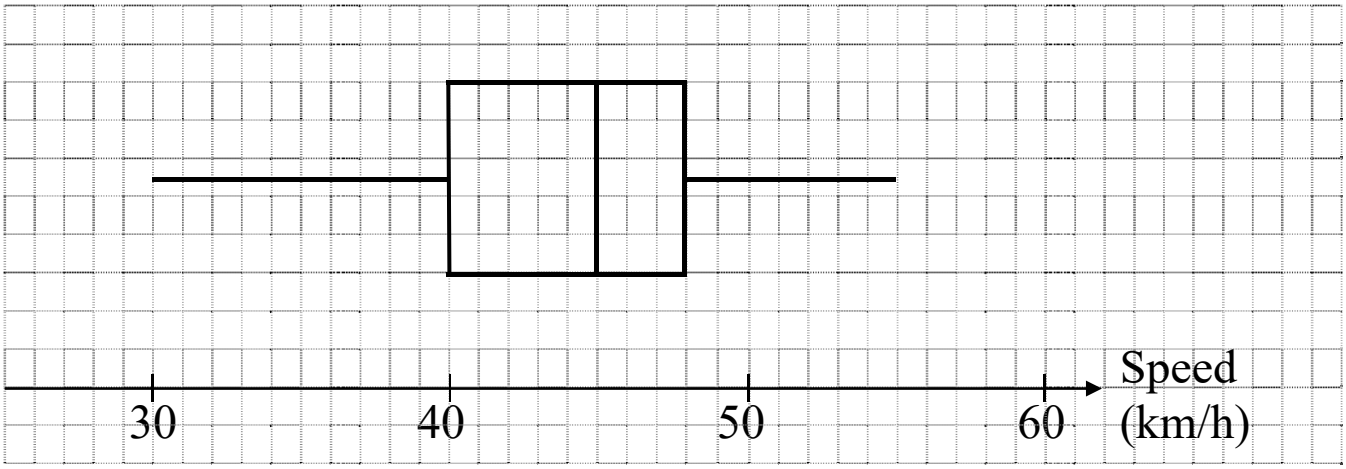
(i) the median speed, [1]

(ii) the interquartile range. [2]

(b) A speed camera is located at the point. Calculate the percentage of cars that will be fined for speeding if the speed limit is 90 km/h. [1]

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The box-and-whisker plot below shows the speed of another 100 cars along the same point of the expressway at 6:30 pm.

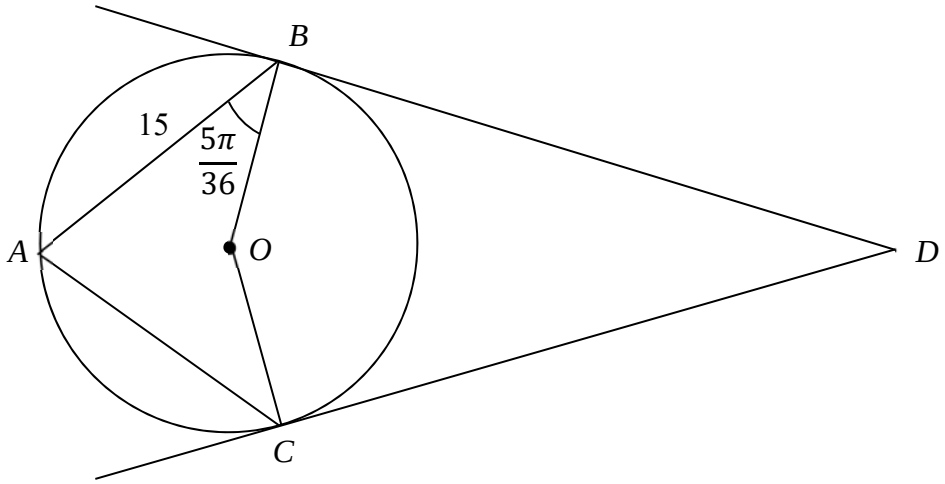


(c) Make 2 comparisons between the speeds of the cars at 11 am and 6:30 pm. [2]

(d) Suggest a reason for the difference in the speed of the cars measured along the same point of the expressway at 11 am and 6:30 pm. [1]

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8. (a) In the figure, A, B and C are points on the circle with centre at O. BD and CD are tangents to the circle at points B and C respectively. It is given that $AB = 15$ cm and $\angle ABO = \frac{5\pi}{36}$ rad.

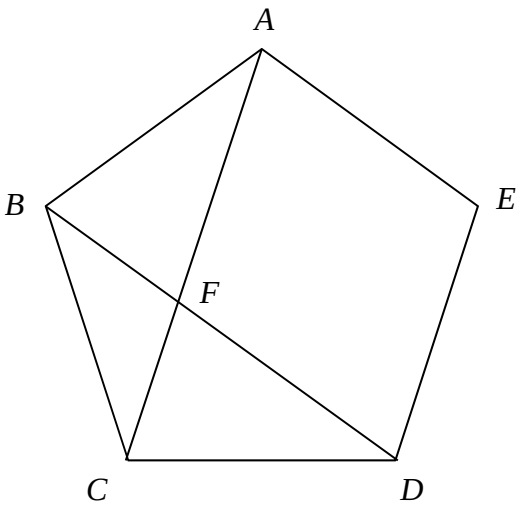


(i) Find the radius of the circle. [3]

(ii) Suppose that $\angle OAC = \frac{5\pi}{18}$ rad, find the area enclosed by the tangents BD and CD and minor arc BC. [4]

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(b) The diagram shows a regular pentagon $ABCDE$. AC and BD intersect at F.



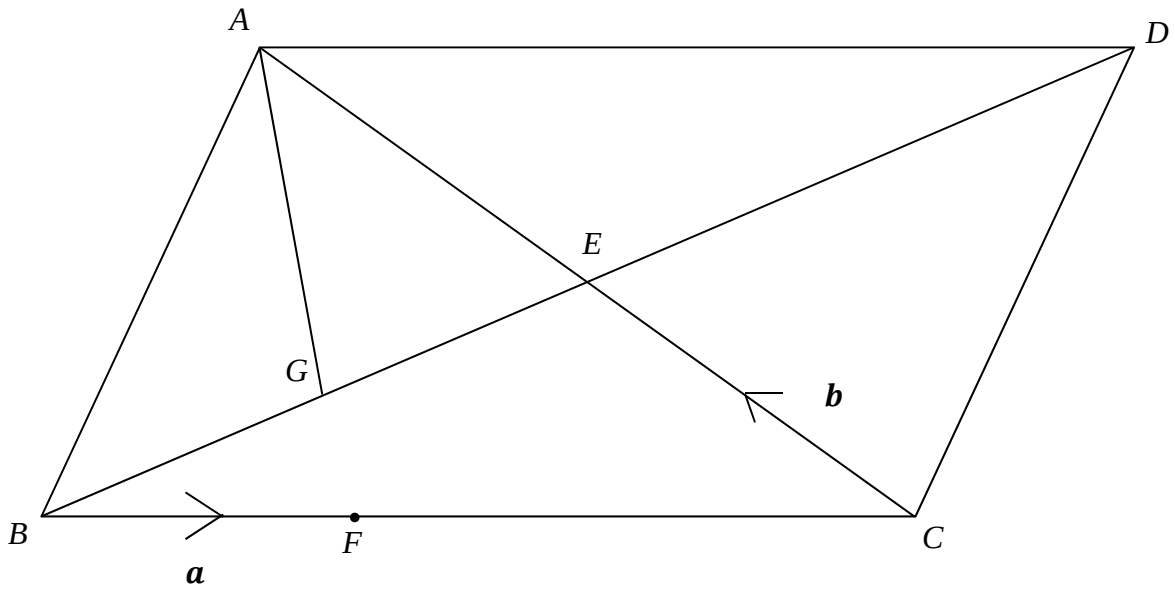
(i) Find the value of $\angle CDF$. [2]

(ii) Show that $\angle DFA = 108°$. [2]

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9. (a) In the diagram, *ABCD* is a parallelogram. The diagonals *AC* and *BD* intersect at *E*. *F* is a point on *BC* such that $\overrightarrow{BC} = 3\overrightarrow{BF}$. *G* is the midpoint of *BE*.

It is given that $\overrightarrow{BF} = \boldsymbol{a}$ and $\overrightarrow{CE} = \boldsymbol{b}$.



(i) Express $\overrightarrow{BA}$ and $\overrightarrow{BD}$ as simply as possible, in terms of $\boldsymbol{a}$ and/or $\boldsymbol{b}$. [2]

(ii) Show that $\overrightarrow{AG} = -\frac{3}{2}(\boldsymbol{a} + \boldsymbol{b})$. [2]

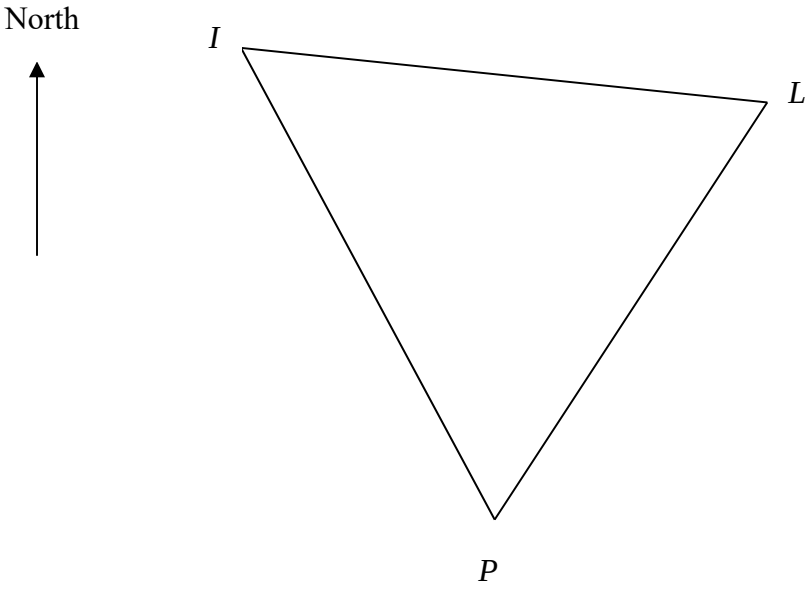
(iii) Express $\overrightarrow{AF}$ as simply as possible, in terms of $\boldsymbol{a}$ and/or $\boldsymbol{b}$.
Hence, show that *A*, *G* and *F* are on a straight line. [2]

(iv) Find the numerical value of $\frac{area\ of\ \Delta BFG}{area\ of\ quadrilateral\ ABCD}$. [1]

(b) It is given that the coordinates of *Q* are (5, −10) and the point *N* lies on *QO* produced such that $\left|\overrightarrow{ON}\right| = 4\sqrt{5}$ units. Express $\overrightarrow{ON}$ as a column vector. [3]

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10. A ship leaves a port at P and sails 21 km towards a lighthouse, L. It then sails 28 km towards an island, I. It is given that the bearing of L from I is 116° and the bearing of P from I is 163°.



(a) Find the bearing of I from L. [1]

(b) Calculate the distance IP. [3]

(c) The ship then returns to the port P, travelling along the route IP. Calculate the distance from P when the ship is closest to the lighthouse, L. [2]

(d) Given that the height of the lighthouse is 500 m, calculate the angle of depression of P from the top of the lighthouse. [2]

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11. The table below shows the time taken by the delivery men of a company, IXEA, to assemble each type of furniture at the delivery location.

Furniture	Time taken to assemble per piece (minutes)
Study table	45
Reading chair	3
Bedside drawer	12
Bunk bed	100

(a) Find the total time taken to assemble one study table and two reading chairs. [1]

(b) On a particular day, the planned delivery route is as shown below.

No.	Location	Order	Estimated time of delivery
1	Sunset Ville	• 1 study table • 2 reading chairs	0900 to 1030
2	Casa Ville	• 1 bedside drawer	1030 to 1200
3	Cloud Cove	• 1 study table • 1 bedside drawer • 2 bunk beds	1300 to 1500

The delivery men left the office at 0915 for the first location at Sunset Ville. After assembling the order, they proceeded to the second location at Casa Ville and arrived at 1030. Additional information that may be needed for the delivery is shown on the Annex.

(i) Calculate the average speed, in km/h, of the delivery van, leaving your answer to the nearest whole number. Do you think the answer is a reasonable estimate of the actual travelling speed of the van? Justify your answer. [3]

(ii) The daily working hours for the delivery men is 0830 to 1600 and they are entitled to have a 45 minutes lunch break. Using the answer found in (i), determine if the delivery men can leave the office punctually at 1630 for that day. Support your answer with appropriate calculations and state one reasonable assumption you made. [6]

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Annex

Table A: Distance Chart between Various Locations

Distance (in km)	IXEA Office	Sunset Ville	Casa Ville	Cloud Cove
IXEA Office		13.8	18.1	9.7
Sunset Ville	13.8		4.7	3.8
Casa Ville	18.1	4.7		6.1
Cloud Cove	9.7	3.8	6.1	

Table B: Speed Limits for Vehicles

Source: https://www.lta.gov.sg/content/ltaweb/en/roads-and-motoring/road-safety-and-regulations/road-regulations.html

SPEED LIMITS FOR VEHICLES

Driving above the speed limit, or too fast for the current conditions, can have severe consequences for the people in the vehicle and other road users. The following speed limits are enforced by LTA to ensure everyone's safety:

Type of Vehicle	Roads	Expressways	Tunnels
Cars & motorcycles	50km/h	70-90km/h	50-80km/h
Buses & coaches	50km/h	60km/h	50-60km/h
Light commercial vehicles (includes Light Goods Vehicles and small buses not exceeding 3.5 tonnes and seating capacity of up to 15 passengers)	50km/h	60-70km/h	50-70km/h
Exceptions: Fire engines, Ambulances, and Government vehicles used by Singapore Police Force or the Singapore Civil Defence Force			

----------END OF PAPER 2----------

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Answers:

1. (a) $n = \frac{3m^2+20k^2}{4k^2-m^2}$

   (b) $\frac{x^2+x+2}{(x+3)(x-3)}$

   (c) k = 6

2. (a)(i) $\frac{60}{x}$ minutes

   (ii) $\frac{60}{x+0.3}$ minutes

   (b) $\frac{60}{x} - \frac{60}{x+0.3} = 3\frac{1}{3}$

   (c) x = 2.1786 or –2.4786

   Time taken for Pump A = 27.5 mins

   (d) Time taken for Pump A and B

   $= \frac{60}{2.1786+(2.1786+0.3)} = 12.883$ minutes

   No, both pumps are not able to drain out all the water completely within 12 minutes.

3. (a) $3^3 + 10 + 5^2 = 62$

   (b) $T_n = 3^{n-1} + n^2 + 5n - 1$

   (c) $S_n = (-1)^n T_n$

4. (a)(i) p = 143

   (ii) Graph

   (b)(i) From graph, no. of toys = 20 toys (± 5)

   (ii) From graph, max. profit = \$152 (± 5)

   corr no. of toys = 98 toys (± 5)

   (c)(i) From graph, gradient = –0.35 (± 0.1)

   (ii) The gradient represents the change of profit over the change in number of toys at x = 160.

   (d)(i) Draw the line y = 100.

   From graph, x = 35.1 or x = 260. (± 5)

5. (a)(i) (136 140 84)

   (ii) The total number of chocolate bars, bags of candy and packets of biscuits bought respectively.

   (b) (968 1451.20)

   (c) a = –1, b = 1

   $Q\begin{pmatrix}1\\-1\end{pmatrix} = (483.20)$

   Total profit = \$483.20

6.(a)(i) (show question)

   (ii) 61.7 cm

6. (b) Total exposed surface area of prism = Area of 2 triangles (without circular holes) + 3 faces of prism + curved SA of cylinder = 189.4360239

   No. of cans of paint needed = 22 cans

7.(a)(i) 83 km/h

   (ii) 15 km/h

   (b) 15%

   (c) The median speed of the cars at 6:30 pm is 45 km/h which is lower than that at 11 am. Therefore the cars are travelling slower at 6:30 pm.

   The IQR of the speed of the cars at 6:30 pm is 8 km/h which is smaller than that at 11 am.Hence, the speed of the cars is more consistent at 6:30 pm / The spread of the speed of cars is wider at 11 am as compared to 6:30 pm.

   (d) Heavy traffic during peak hour.

8. (a)(i) 8.28 cm

   (ii) 166 cm^2

   (b)(i) 36°

   (ii) show question

9.(a)(i) $\overrightarrow{BA} = 3\mathbf{a} + 2\mathbf{b}$

   $\overrightarrow{BD} = 6\mathbf{a} + 2\mathbf{b}$

   (ii) show question

   (iii) $\overrightarrow{AF} = -2(\mathbf{a} + \mathbf{b})$

   $3\overrightarrow{AF} = 4\overrightarrow{AG}$, hence A, F and G are collinear with A as the common point.

   (iv) $\frac{1}{24}$

   (b) $\overrightarrow{ON} = \begin{pmatrix}-4\\8\end{pmatrix}$

10. (a) 296°

   (b) 23.7 km

   (c) 4.65 km

   (d) 1.4°

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11. (a) 51 minutes

(b) (i) Distance from Office → Sunset Ville → Casa Ville = 13.8 + 4.7 = 18.5 km

Total time taken travelling = 75 mins – 51 mins (assembly) = 24 mins

Average travelling speed = 46.25 km/h = 46 km/h (nearest whole no.)

A reasonable estimate as it's within the speed limit. OR
Not a reasonable estimate as the time taken to move the furniture up/wait for the lift is not considered. As such, less time spent on the road and actual speed may be faster.

(ii) Total distance from Office → Sunset Ville → Casa Ville → Cloud Cove → Office
= 13.8 + 4.7 + 6.1 + 9.7
= 34.3 km

Total time taken (for travelling) = 34.3 km ÷ 46 km/h = 45 mins (to the nearest min)
Total time taken (for lunch) = 45 mins
Total time taken (for assembling) = 45 + 2(3) + 12 + 45 + 12 + 200 = 320 mins

Total time taken = 45 + 45 + 320 = 410 mins = 6 h 50 mins

0915 (time they left office) $\xrightarrow[6\text{h } 50 \text{ mins}]{}$ 1605

The delivery men will be able to leave punctually.

<u>Assumption:</u> (Any one)
1. Owners are at home when delivery men reach.
2. No traffic jams.
3. Traffic condition is more or less the same from one location to another such that average speed is 46 km/h.

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