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Name:

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Class:

**4NA**



**BEDOK GREEN SECONDARY SCHOOL**

**Preliminary Examination 2017**

**4NA**

**MATHEMATICS**

**4045/01**

Paper 1

18 July 2017

2 h

Candidates answer on the Question Paper

**READ THESE INSTRUCTIONS FIRST**

Write your class, register number and name on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

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

Answer **all** questions.

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

The total marks for this paper is 80.

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  $\pi$ , use either your calculator value or 3.142.

**For Examiner's Use**

**Total**

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**[Turn Over**

**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*

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

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

Answer **all** questions.

1. (a) Write  $107\frac{1}{2}\%$  as a fraction in its lowest terms.

Answer ..... [1]

- (b) By writing each value correct to 2 significant figures, estimate the value of  $\frac{10.55 - \sqrt[3]{125.6}}{5.04}$ . Show your working.

Answer ..... [1]

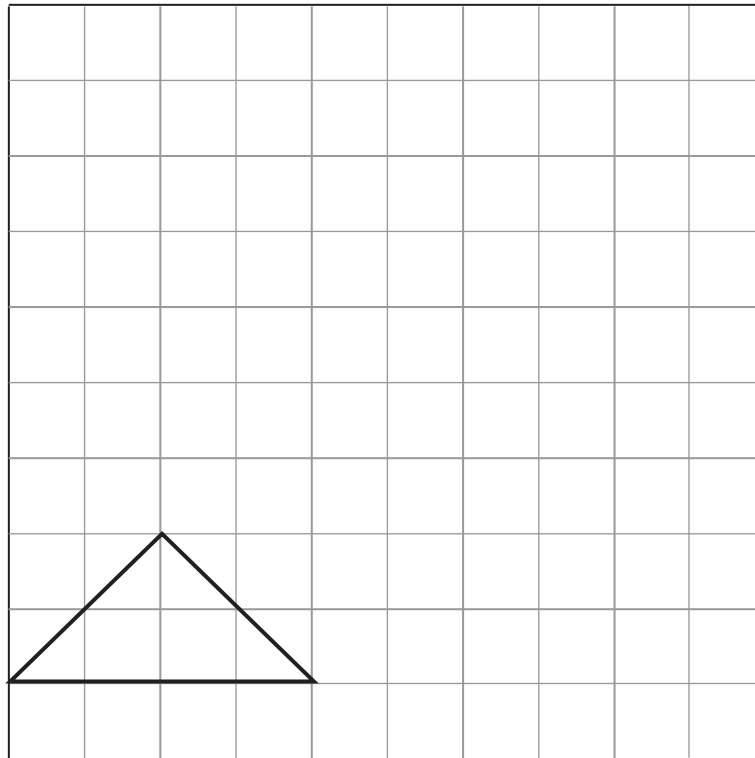
2. (a) Solve  $16 - 2x \leq 21$ .

Answer ..... [1]

- (b) Find the smallest integer number that satisfies the inequality in (a).

Answer ..... [1]

3. Draw an enlargement of the triangle using a scale factor 1.5.



[2]

4. In a class of 40 pupils, 26 are boys and 10 of them wear spectacles. Among the girls,  $\frac{3}{7}$  of them wear spectacles. If a pupil is selected at random, what is the probability that the pupil chosen will be

(a) a girl,

Answer ..... [1]

(b) a female pupil who does not wear spectacles.

Answer ..... [1]

5. The numbers 648 and 126, written as products of their prime factors, are  $648 = 2^3 \times 3^4$  and  $126 = 2 \times 3^2 \times 7$ . Find the
- (a) largest integer which is a factor of 126 and 648.

Answer ..... [1]

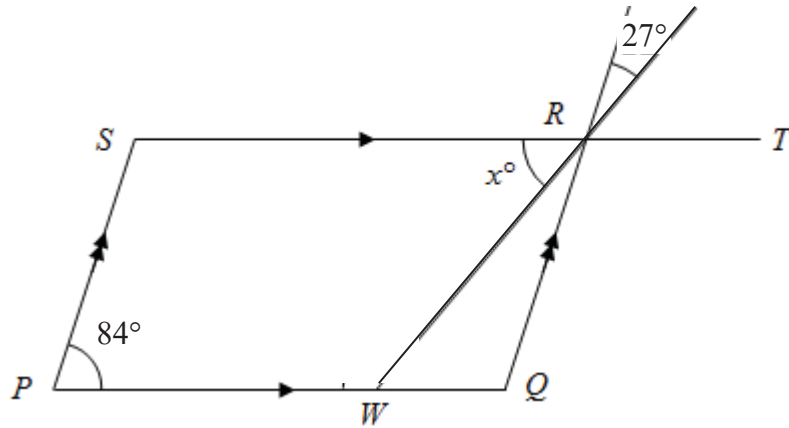
- (b) smallest integer  $k$ , such that  $\frac{648}{k}$  is a perfect cube.

Answer ..... [1]

6.  $p$  is directly proportional to  $q^2$ . When  $q$  has a certain value,  $p = 48$ . Find the value of  $p$  when this value of  $q$  is halved.

Answer  $p =$  ..... [2]

7.



In the diagram,  $QWR$  and  $WRU$  are straight lines.

Show, giving your reasons clearly, that  $x$  is  $57^\circ$ .

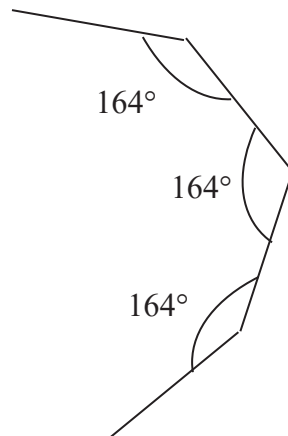
Answer .....

.....

.....

..... [2]

8.



Jane says that the diagram shows part of a regular polygon.

Is she correct?

Show your working.

Answer .....

.....

.....

..... [2]

9. (a) Given that  $3^{-4} \div \sqrt[3]{3} = 3^y$ , find  $y$ .

.

Answer  $y = \dots\dots\dots$  [2]

- (b) Given that  $25^x = \frac{1}{125}$ , find  $x$ .

Answer  $x = \dots\dots\dots$  [2]

10. Simplify

(a)  $3xy^2 \div \frac{6x^0}{y},$

Answer  $\dots\dots\dots$  [2]

(b)  $\frac{2}{y-3} - \frac{5}{y^2-9}.$

Answer  $\dots\dots\dots$  [2]



11. Factorise completely.

(a)  $64x^2 - 4y^2$

Answer ..... [2]

(b)  $2y + 2 - 5y^2 - 5y$

Answer ..... [2]

12. A shop is selling \$20.50 for a box of chocolate.  
It offers a 10% discount on the first box of chocolate and a discount of 12% on the second box of chocolate.

(a) What is the total cost of the two boxes of chocolate after the discount?

Answer \$..... [2]

(b) What is the overall percentage discount on the purchase of two boxes of chocolate?

Answer .....% [2]

- 13.** A map is drawn to a scale of 5 cm to 2 km.  
**(a)** Express the scale of the map in the form of 1 :  $r$ .

*Answer* ..... [1]

- (b)** The length of a river on the map is 20 cm. Find the actual length of the river in km.

*Answer* .....km [1]

- (c)** Find the actual area of a pond if its area on the map is  $10 \text{ cm}^2$ .

*Answer* ..... $\text{km}^2$  [2]

14. (a) Construct triangle  $ABC$  where  $BC = 6$  cm and  $AC = 9$  cm.  $AB$  has already been drawn for you.



- [1]
- (b) Measure the reflex angle  $ACB$ . [1]
- (c) Construct the
- (i) bisector of angle  $ABC$ . [1]
- (ii) perpendicular bisector of  $AB$ . [1]
- (d) These two bisectors meet at  $Z$ . Complete the statement below.
- The point  $Z$  is equidistant from the lines \_\_\_\_\_ and \_\_\_\_\_ and equidistant from the points \_\_\_\_\_ and \_\_\_\_\_. [1]

15. (a) Given that  $x^2 - 9x + 16 = (x + a)^2 + b$ , find  $a$  and  $b$ .

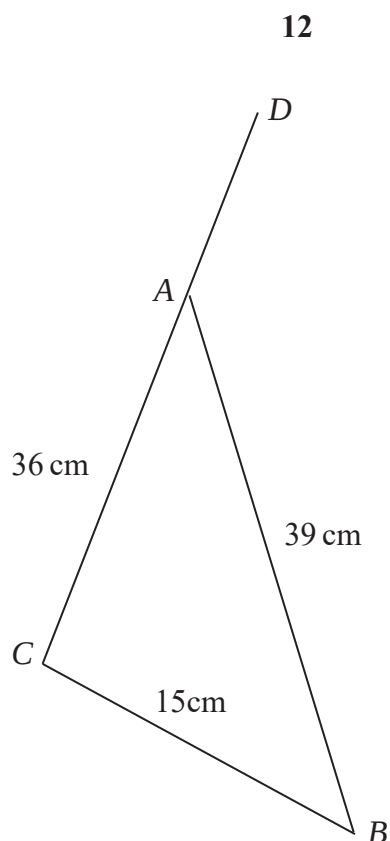
Answer  $a = \dots\dots\dots$  [1]

$b = \dots\dots\dots$  [1]

- (b) Hence, solve  $x^2 - 9x + 16 = 0$ .

Answer  $x = \dots\dots\dots$  [3]

16.



In the triangle  $ABC$ ,  $AB = 39$  cm,  $BC = 15$  cm,  $AC = 36$  cm, and  $CA$  is produced to point  $D$ .

(a) Determine if  $ABC$  is a right angled triangle. [2]

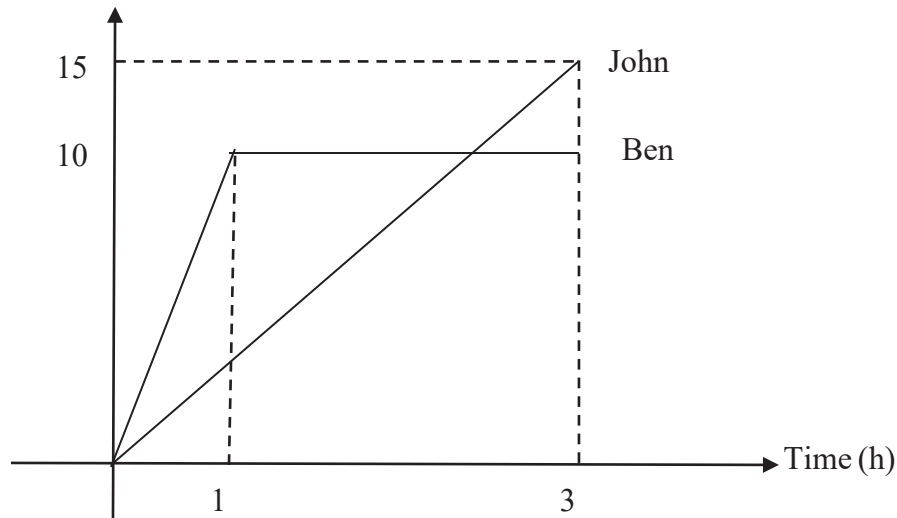
(b) Find  $\cos \angle DAB$ .

Answer ..... [1]

(c) Calculate angle  $ABC$ .

Answer ..... ° [2]

17. The diagram shows the speed-time graph of 2 cyclists, Ben and John from Town A to B.



- (a) Calculate the acceleration of Ben during the first 1 hour.

Answer .....km/h<sup>2</sup> [1]

- (b) What is John's speed at 1 hour?

Answer .....km/h [2]

- (c) John has overtaken Ben when he started to cycle faster than Ben. Do you agree? Explain and show your working clearly.

Answer .....

.....

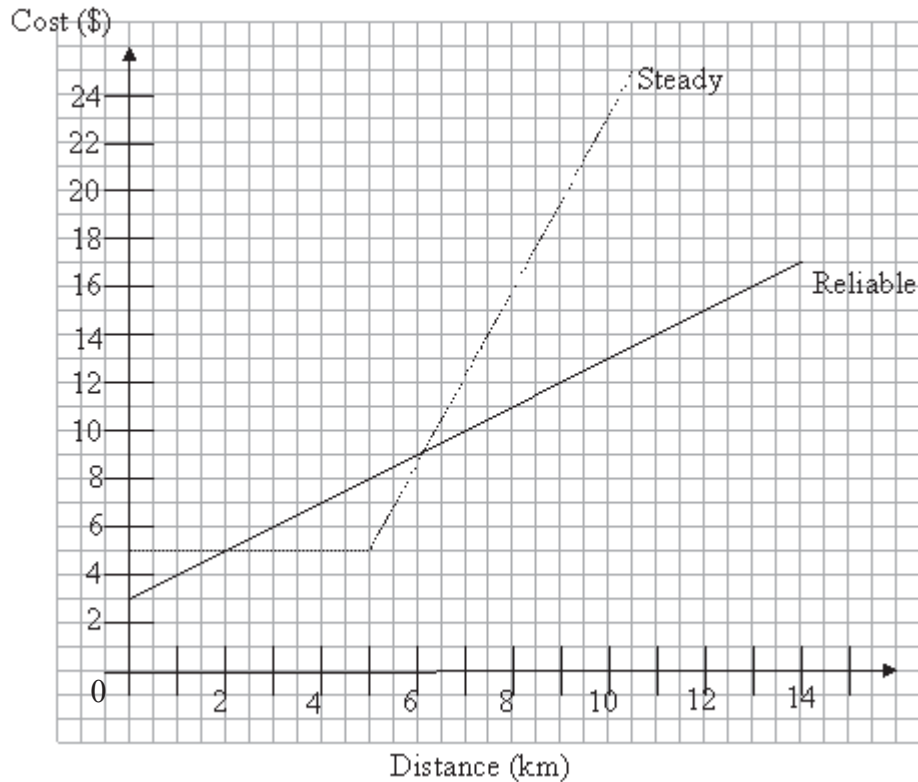
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.....

.....

.....[2]

18. The graphs below show the charges of 2 taxi companies, Steady Taxi and Reliable Taxi.



- (a) Mr Lee travelled 5 km by Reliable Taxi. How much did he have to pay?

Answer \$ .....[1]

- (b) How much would Mr Lee save if he travel by Steady Taxi instead?

Answer \$ .....[1]

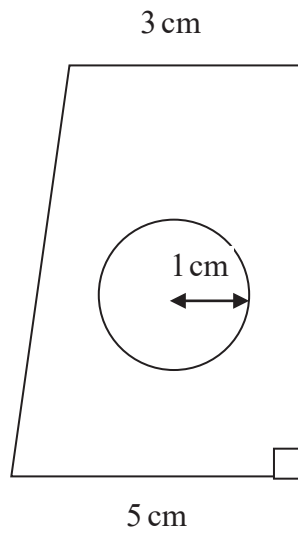
- (c) The equation representing the graph for Reliable Taxi is given  $C = p + qD$  where  $C$  is the cost of taxi charges and  $D$  is the distance travelled. Find the value of  $p$  and  $q$ .

Answer  $p =$  .....

$q =$  ..... [2]

- (d) On a particular week, Steady Taxi offers a promotion of \$5 off all rides. Draw on the grid above the graph representing the taxi charges for that week. [1]

19. A pendant is made of a trapezium and a circle with radius of 1 cm is cut from the trapezium.



Find

- (a) the area of the circle, (use  $\pi = 3.142$ ),

Answer .....cm<sup>2</sup>[1]

- (b) the height of the trapezium given that the area is 24 cm<sup>2</sup>,

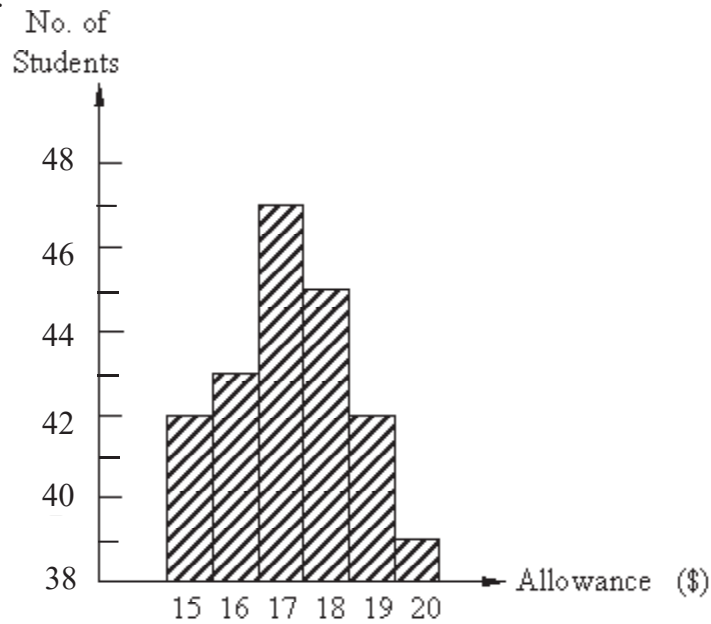
Answer .....cm [2]

- (c) the perimeter of the pendant.

Answer ..... cm[2]



20. The following histogram shows the survey findings of students' weekly allowance in a School A.



- (a) Find the number of students in School A.

Answer .....[1]

- (b) Calculate the percentage of students whose weekly allowance is more than \$17.

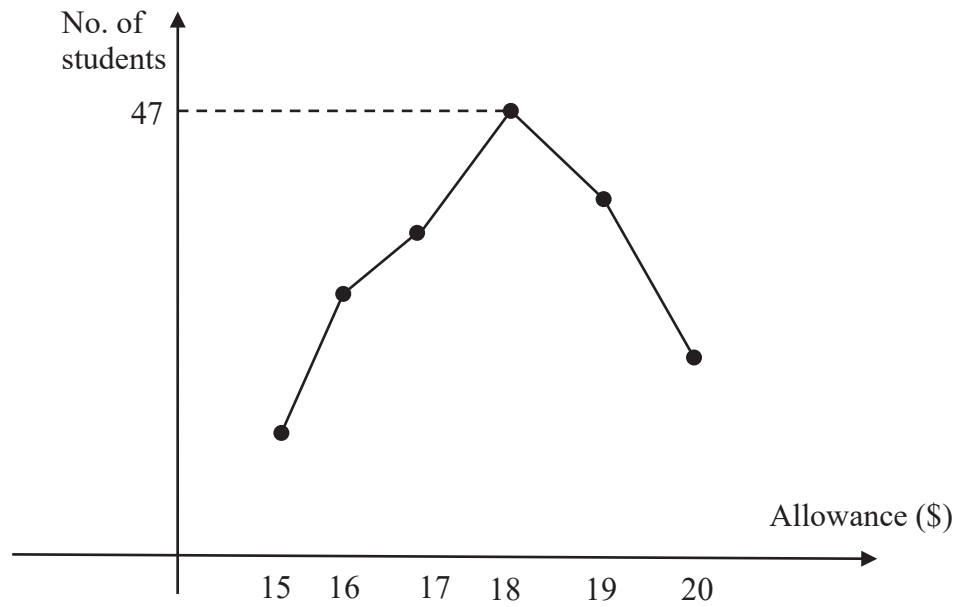
Answer .....%.[2]

- (c) Calculate the mean allowance.

Answer \$.....[2]

(d)

The following line graph shows the survey findings of students' weekly allowance in School B,



It is misleading to say that there is a greater increase in the number of students in School A than School B from \$16 to \$17. Explain why this is so.

Answer .....

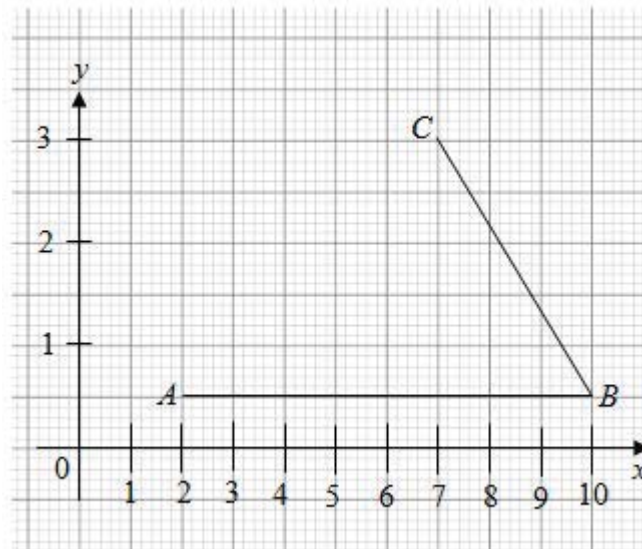
.....

.....

.....

.....[2]

21. The diagram below shows points  $A(2, 0.5)$ ,  $B(10, 0.5)$  and  $C(7, 3)$ .



- (a) Find the equation of the line  $BC$ .

Answer .....[2]

- (b) Find 2 possible coordinates of point  $D$  such that  $A$ ,  $B$ ,  $C$  and  $D$  form the vertices of a parallelogram.

Answer ( ..... , .....).

( ..... , ..... ) [2]

- (c) Draw the line  $y = -\frac{1}{2}x + 2$ . [1]

- (d) Hence solve the simultaneous equations  $y = -\frac{1}{2}x + 2$  and  $y = \frac{1}{2}$ .

Answer  $x = \dots\dots\dots$

$y = \dots\dots\dots$  [2]

**End of paper**

Name:

Register Number:

Class:

**4NA**



**BEDOK GREEN SECONDARY SCHOOL**

**Preliminary Examination 2017**

**4NA**

**MATHEMATICS**

**4045/02**

Paper 2

19 July 2017

2 h

Additional Materials :

Answer Paper

Graph paper ( 1 sheet )

**READ THESE INSTRUCTIONS FIRST**

Write your name, register number and class 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, glue or correction fluid.

**Section A**

Answer **all** questions.

**Section B**

Answer **one** question.

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

The total marks for this paper is 60.

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  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

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

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**Total**

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**[Turn Over**

**Mathematical Formulae***Compound Interest*

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

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

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

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

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

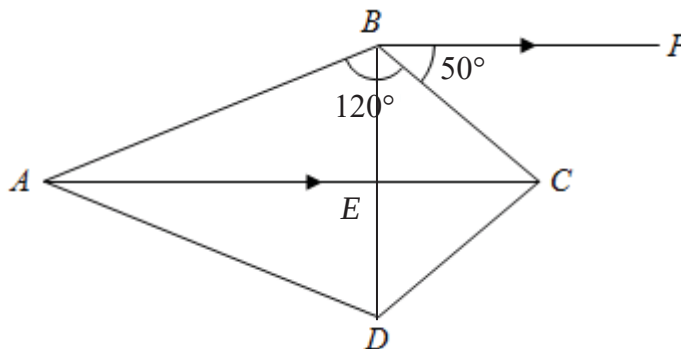
**Section A** (52 marks)Answer **all** questions.

1. One astronomical unit (AU) is equivalent to 150 gigametres where 1 gigametre =  $1 \times 10^9$  m.
- (a) Express 150 gigametres in metres, giving your answer in standard form. [1]
- (b) Given that the speed of light is  $3 \times 10^8$  m/s, find the number of seconds light takes to travel 3AU. [2]
- 

2. (a) Given that  $V = \frac{Rx}{x+b}$ , express  $x$  in terms of  $V$ ,  $b$  and  $R$ . [3]
- (b) \$50 is divided in the ratio  $p:q$  where  $p < q$ . Write down an expression in terms of  $p$  and  $q$ , for the bigger amount. [1]
- 

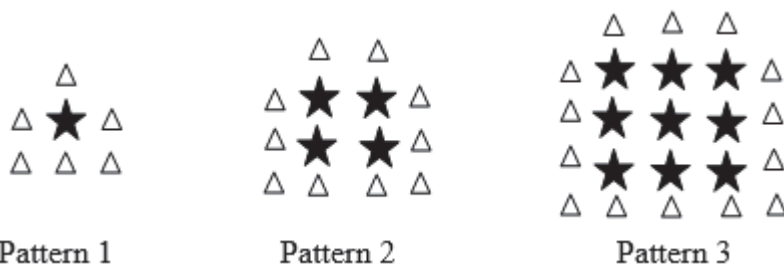
3. (a) Solve  $5 - \frac{1}{6}(x-4) = 2$ . [2]
- (b) Solve  $x - 6 = \frac{x-9}{x}$ .  
Give your answers to 3 decimal places. [3]
- 

4. (a) The diagram shows a kite  $ABCD$ .  $BP$  is parallel to  $AC$ ,  $\angle ABC = 120^\circ$ ,  $\angle PBC = 50^\circ$  and line  $BD$  and  $AC$  meet at point  $E$ . Find, stating the reasons clearly,
- (i)  $\angle BCD$ , [1]
- (ii)  $\angle ABE$ . [2]



- (b) The monthly wages of 5 employees are listed below:  
\$5200   \$5000   \$2000   \$5600   \$5600
- (i) Find the median wage. [1]
- (ii) Explain why median wage is a better reflection of the monthly income of the employees than mean wage.
-

5. Jacelyn used objects in the shape of triangle and star to make a series of pattern. The first three patterns are as shown below.



The number of objects used in the above patterns are tabulated in the table shown below.

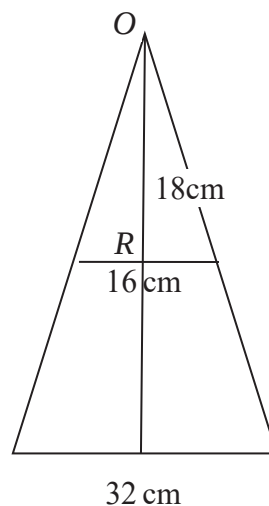
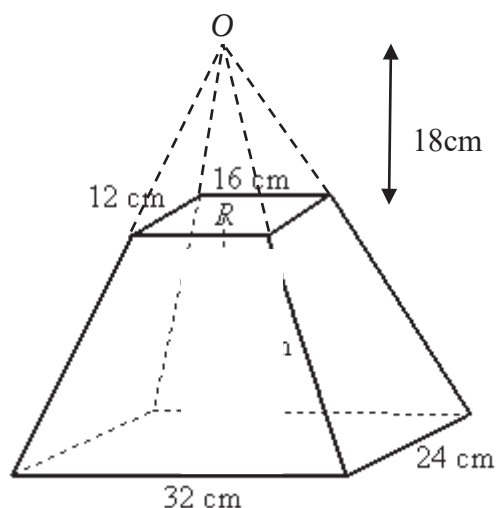
| Pattern Number<br>( $n$ ) | Number of stars<br>( $s$ ) | Number of triangles<br>( $t$ ) |
|---------------------------|----------------------------|--------------------------------|
| 1                         | 1                          | 6                              |
| 2                         | 4                          | 10                             |
| 3                         | 9                          | 14                             |
| 4                         | $a$                        | $b$                            |

- (a) Write down the values of  $a$  and  $b$ . [2]  
 (b) Write down an equation connecting  $n$  and  $s$ . [1]  
 (c) Write down an equation connecting  $n$  and  $t$ . [1]  
 (d) Is there a pattern in the sequence that is made up of 120 triangles? [2]  
 Give an explanation for your answer.
- 

6. John is 3 years older than twice the age of his sister, Mary.

- (a) Given that John's age is  $y$  years and Mary's age is  $x$  years, write down an equation in  $x$  and  $y$ . [1]  
 (b) If the combined ages of John and Mary is 12 years, write down another equation in  $x$  and  $y$ . [1]  
 (c) Solve the pair of simultaneous equations. [3]  
 (d) Find the Mary's age in 2 years time. [1]
-

7. The solid below is obtained when the top portion of a rectangular pyramid is cut off, leaving behind a flat rectangular top of 16 cm by 12 cm and the vertical height of the pyramid cut off,  $RO$  is 18 cm. The dimension of the rectangular base is 32 cm by 24 cm. Find
- (a) the height of the original pyramid. [2]
- (b) the volume of the remaining solid. [2]



Front View of the original pyramid

- (c) To reduce wastage, the pyramid solid that is cut off is then recast into a sphere, find the radius of the sphere. [2]

8. Answer the whole of this question on a single sheet of graph paper.

The table below shows some values of  $x$  and the corresponding values of  $y$ , correct to 1 decimal place, for the graph of  $y = \frac{11}{x} + x - 5$ .

|     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| $x$ | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   |
| $y$ | 7.0 | 2.5 | $q$ | 1.8 | 2.2 | 2.8 | 3.6 | 4.4 |

- (a) Find the value of  $q$ . [1]
- (b) Using the scale of 2 cm to represent 1 unit on each axis, draw the graph of  $y = \frac{11}{x} + x - 5$  for  $1 \leq x \leq 8$ . [3]
- (c) Use your graph to find the values of  $x$  when  $y = 3$ . [1]
- (d) State the coordinates of the minimum point. [1]
- (e) By drawing a tangent, calculate the gradient of the curve at the point  $x = 4$ . [2]



9. James wants to buy a new car on hire purchase and the cash price of the car he wants to buy is \$280 000. He paid a deposit of \$130 000 and takes a loan from the bank to pay for the balance amount.

He is deciding which Car Financing Scheme to use for his loan plan. Below are the interest rates presented to him by the bank for his loan:

| Period of Financing (years) | Simple interest rate per annum (%) | Compound Interest rate per annum (%) |
|-----------------------------|------------------------------------|--------------------------------------|
| 1                           | 3.25                               | 3.5                                  |
| 2                           | 3.25                               | 3.5                                  |
| 3                           | 3.25                               | 3.5                                  |
| 4                           | 3.25                               | 3.5                                  |
| 5                           | 3.25                               | 3.5                                  |
| 6                           | 3.25                               | 3.5                                  |
| 7                           | 3.5                                | 3.7                                  |
| 8                           | 3.5                                | 3.7                                  |
| 9                           | 3.5                                | 3.7                                  |
| 10                          | 3.5                                | 3.7                                  |

There are 2 financing schemes available. The total amount of loan will be paid in monthly instalments throughout the loan period.

Details of the 2 schemes are as follows:

**Scheme A**

He can repay his loan in 10 years using the simple interest rate.

**Scheme B**

He can repay his loan in 10 years using the compound interest rate.

He can opt for an early repayment in this scheme where in the event he decide to repay the outstanding loan before the loan period ends. He will receive a rebate on the interest due to the early repayment.

Early repayment is allowed after 6 years of loan payment in monthly instalments. The balance of the loan must be paid in full and he will also receive a rebate which **can be deducted from the loan**. The rebate is calculated using the formula below:

$$\text{Rebate} = \frac{n(n+1)}{N(N+1)} \times TC \times 80\%$$

where:

$n$  represents the balance loan period in months

$N$  represents the original loan period in months

$TC$  represents the total amount of interest payable over the loan period

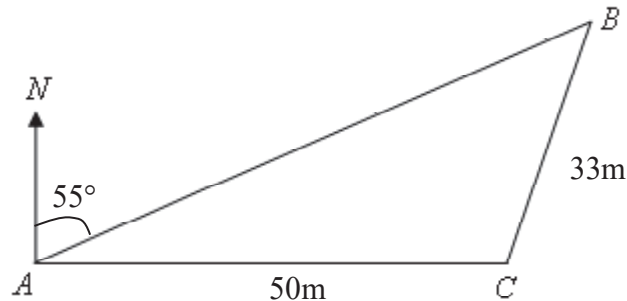
- (a) Calculate the hire purchase price of the car if James use Scheme A for a loan period of 10 years. [2]

- (b) Calculate the hire purchase price of the car if James use Scheme B for a loan period of 10 years without early repayment. [2]
- (c) Given that James has a budget of \$2000 per month to pay his monthly instalment, justify if both schemes in (a) and (b) are within his monthly budget. Show your working clearly. [2]
- (d) James is considering an early repayment for Scheme B which he can deduct the rebate from his loan amount. Justify which scheme would he choose if early repayment is a possible option for him. Show your working clearly. [2]
-

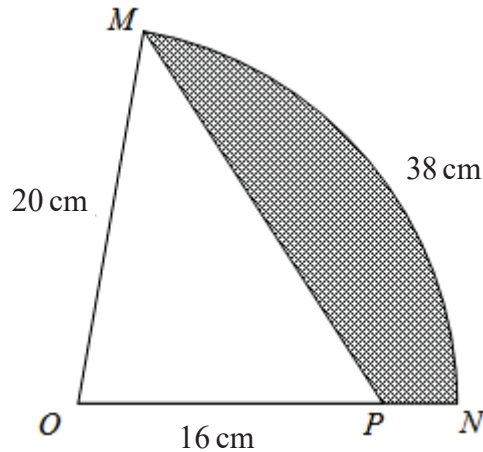
**Section B (8 marks)**

Answer any 1 question from this section. Each question carries 8 marks.

10.  $A$ ,  $B$  and  $C$  are three cones placed on a soccer field.  $C$  is 50 m due east of  $A$ .  $B$  is 33 m from  $C$ , and on a bearing of  $055^\circ$  from  $A$ .  $\angle ACB$  is obtuse.



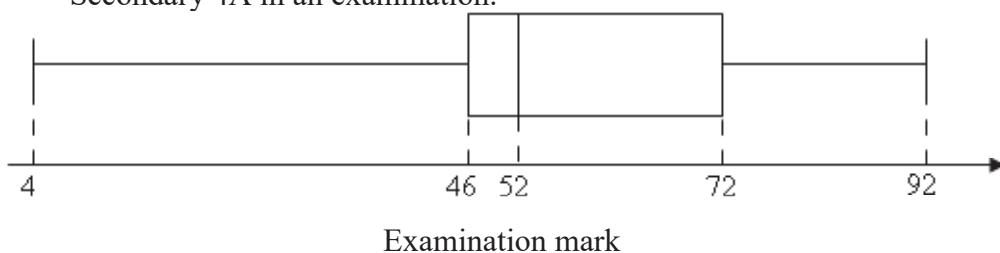
- (a) (i) Find the bearing of  $A$  from  $B$ . [1]
- (ii) Find the angle  $ABC$ . [2]
- (ii) Given that a player runs along  $AB$ , how far does he need to run from  $A$  such that he is closest to  $C$ ? [2]
- (b) In the diagram,  $MON$  is a sector of a circle, centre  $O$  and radius 20 cm, and the length of the arc  $MN$  is 38 cm.  $P$  is a point on  $ON$  such that  $OP = 16$  cm.



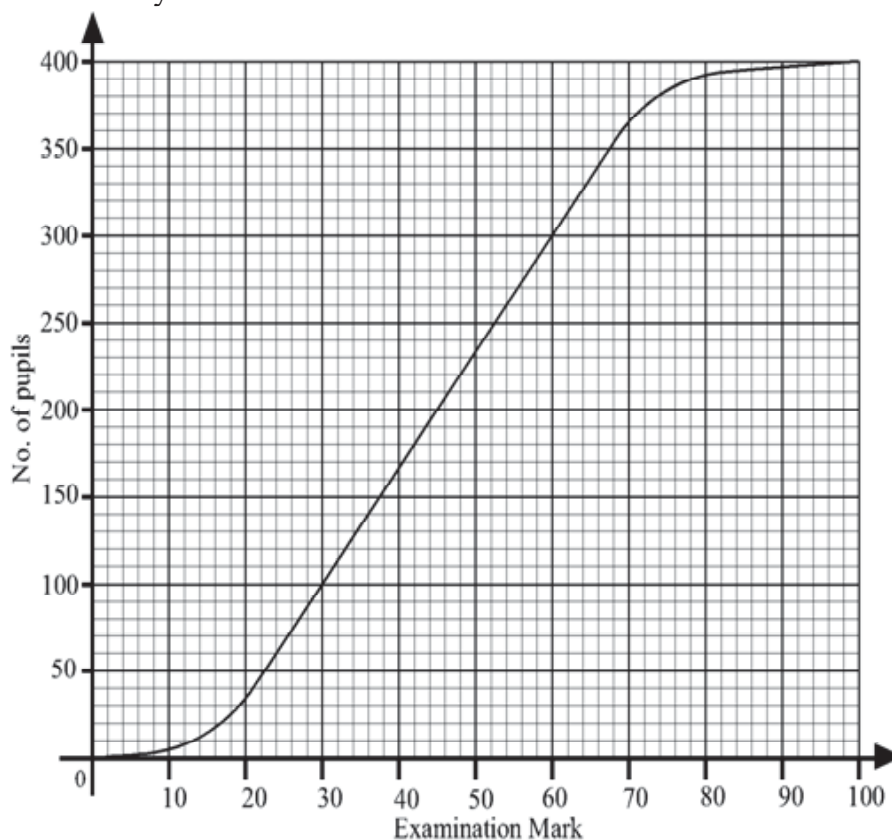
Find

- (i)  $\angle MON$ , in radians. [1]
- (ii) the perimeter of the shaded region. [2]

11. (a) The box-and-whiskers diagram below shows the marks of 40 students in Secondary 4A in an examination.



- (i) State the median mark. [1]
- (ii) Find the inter-quartile range. [1]
- (iii) Two students are chosen at random from the group. Find the probability that both students score more than or equal to 72 marks but less than 92 marks. [2]
- (b) The cumulative frequency graph shows the distribution of the marks of the entire Secondary 4 cohort in the same examination.



- (i) Find the interquartile marks of the whole cohort. [1]
- (ii) Calculate the passing mark if 45% of the cohort pass. [1]
- (iii) Secondary 4A is said to have done better compared to the rest of the cohort. Do you agree? Give your reasons clearly. [2]

**End of paper**



Name:

Register Number:

Class:

**4NA**



**BEDOK GREEN SECONDARY SCHOOL**

**Preliminary Examination 2017**

**4NA**

**MATHEMATICS (Solution)**

**4045/01**

Paper 1

18 July 2017

2 h

Candidates answer on the Question Paper

**READ THESE INSTRUCTIONS FIRST**

Write your class, register number and name on all the **work you hand in**.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

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

Answer **all** questions.

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

The total marks for this paper is 80.

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  $\pi$ , use either your calculator value or 3.142.

**For Examiner's Use**

**Total**

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**[Turn Over**

**Mathematical Formulae***Compound Interest*

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

*Mensuration*

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

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

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

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

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

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

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

*Trigonometry*

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

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

*Statistics*

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

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

Answer **all** questions.

1. (a) Write  $107\frac{1}{2}\%$  as a fraction in its lowest terms.

$$\frac{107\frac{1}{2}}{100} = 1\frac{3}{40}$$

Answer .....  $1\frac{3}{40}$  ..... [1]

- (b) By writing each value correct to 2 significant figures, estimate the value of  $\frac{10.55 - \sqrt[3]{125.6}}{5.04}$ . Show your working.

$$\begin{aligned}\frac{10.55 - \sqrt[3]{125.6}}{5.04} &= \frac{11 \times \sqrt[3]{125}}{5} \\ &= \frac{11 \times 5}{5} = 11\end{aligned}$$

Answer ..... 11 ..... [1]

2. (a) Solve  $16 - 2x \leq 21$ .

$$\begin{aligned}16 - 2x &\leq 21 \\ -2x &\leq 21 - 16 \\ -2x &\leq 5 \\ x &\geq -2\frac{1}{2}\end{aligned}$$

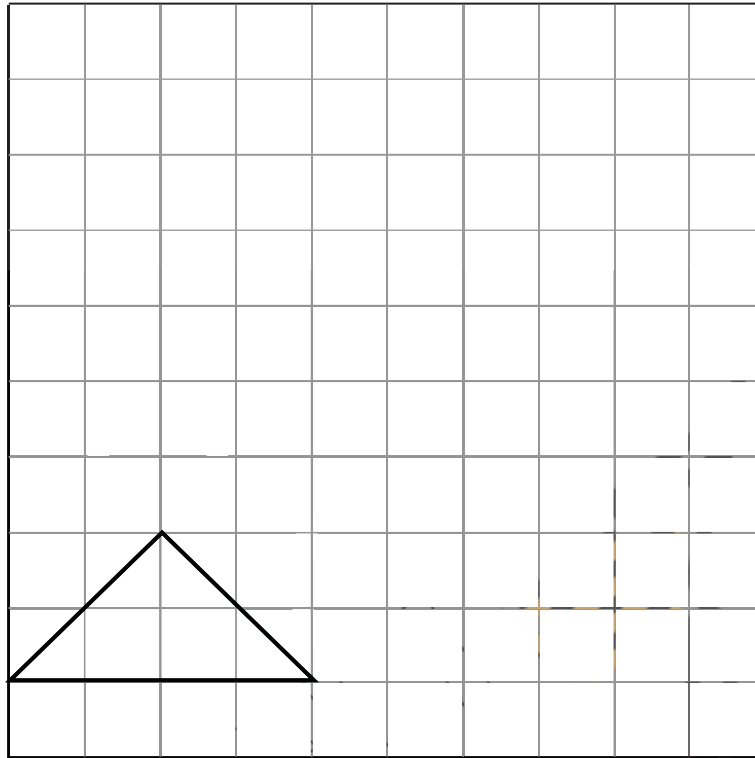
Answer .....  $x \geq -2\frac{1}{2}$  ..... [1]

- (b) Find the smallest integer number that satisfies the inequality in (a).

Answer ..... -2 ..... [1]



3. Draw an enlargement of the triangle using a scale factor 1.5.



[2]

4. In a class of 40 pupils, 26 are boys and 10 of them wear spectacles. Among the girls,  $\frac{3}{7}$  of them wear spectacles too. If a pupil is selected at random, what is the probability that the pupil chosen will be

(a) a girl,

Answer .....  $\frac{7}{20}$  ..... [1]

(b) a female pupil who does not wear spectacles.

$$\frac{3}{7} \times 14 = 6$$

Answer .....  $\frac{3}{20}$  ..... [1]

5. The numbers 648 and 126, written as products of their prime factors, are  $648 = 2^3 \times 3^4$  and  $126 = 2 \times 3^2 \times 7$ . Find the
- (a) largest integer which is a factor of 126 and 648.

Answer .....18..... [1]

- (b) smallest integer  $k$ , such that  $\frac{648}{k}$  is a perfect cube.

Answer .....3..... [1]

6.  $p$  is directly proportional to  $q^2$ . When  $q$  has a certain value,  $p = 48$ . Find the value of  $p$  when this value of  $q$  is halved.

$$p = kq^2$$

$$48 = kq^2$$

$$k = \frac{48}{q^2} \text{-----M1}$$

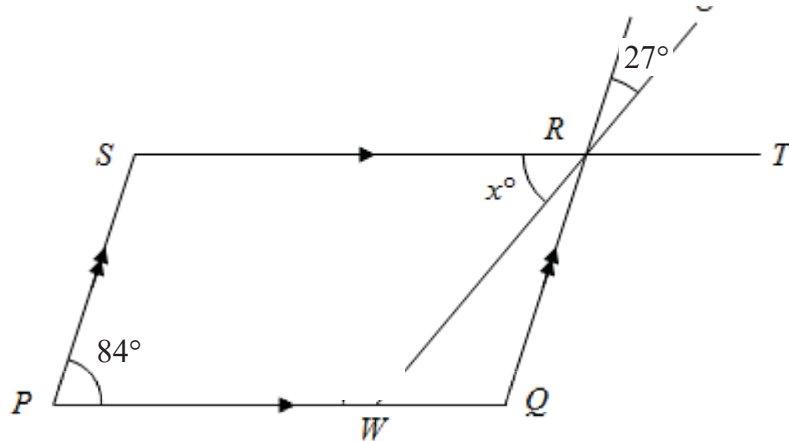
$$\text{new } p = \frac{48}{q^2} \times \left(\frac{q}{2}\right)^2$$

$$= \frac{48}{4}$$

$$= 12 \text{-----A1}$$

Answer  $p =$ .....12..... [2]

7.



In the diagram,  $QRV$  and  $WRU$  are straight lines.

Show, giving your reasons clearly, that  $x$  is  $57^\circ$ .

*Answer*  $\angle SRQ = 84^\circ$  (opposite angles of a parallelogram)

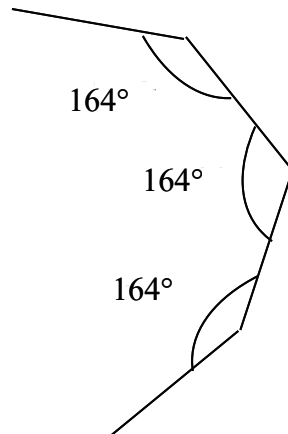
$$x = 84^\circ - 27^\circ \text{ (adj. angles) } \text{----- M1}$$

$$= 57^\circ \text{----- A1}$$

1 mark deducted for no reason

[2]

8.



Jane says that the diagram shows part of a regular polygon.

Is she correct?

Show your working.

*Answer* ..... 1 exterior angle  $= 180^\circ - 164^\circ = 16^\circ$

$$\text{No. of sides} = \frac{360^\circ}{16^\circ} = 22.5 \text{----- M1}$$

She is not correct as number of sides of a polygon must be an integer.-----A1

9. (a) Given that  $3^{-4} \div \sqrt[3]{3} = 3^y$ , find  $y$ .

$$3^{-4} \div \sqrt[3]{3} = 3^y$$

$$3^{-4} \div 3^{\frac{1}{3}} = 3^y \text{ ----- M1}$$

$$3^{-4\frac{1}{3}} = 3^y$$

$$y = -4\frac{1}{3} \text{ ----- A1}$$

$$\text{Answer } y = \dots\dots\dots y = -4\frac{1}{3} \dots\dots\dots [2]$$

- (b) Given that  $25^x = \frac{1}{125}$ , find  $x$ .

$$25^x = \frac{1}{125}$$

$$(5^2)^x = \frac{1}{5^3} \text{ ----- M1}$$

$$5^{2x} = 5^{-3}$$

$$x = -1\frac{1}{2} \text{ ----- A1}$$

$$\text{Answer } x = \dots\dots\dots -1\frac{1}{2} \dots\dots\dots [2]$$

10. Simplify

(a)

$$3xy^2 \div \frac{6x^0}{y}$$

$$3xy^2 \div \frac{6x^0}{y}$$

$$= 3xy^2 \times \frac{y}{6} \text{ ----- M1}$$

$$= \frac{xy^3}{2} \text{ ----- A1}$$

$$\text{Answer} \dots\dots\dots \frac{xy^3}{2} \dots\dots\dots [2]$$

(b)  $\frac{2}{y-3} - \frac{5}{y^2-9}$ .

$$\frac{2}{y-3} - \frac{5}{y^2-9} = \frac{2(y+3)-5}{(y+3)(y-3)} \text{ ----- M1}$$

$$= \frac{2y+1}{(y+3)(y-3)} \text{ ----- A1}$$

$$\text{Answer} \dots\dots\dots \frac{2y+1}{(y+3)(y-3)} \dots\dots\dots [2]$$

**11. Factorise completely**

**(a)**  $64x^2 - 4y^2$ .

$$64x^2 - 4y^2 = 4(16x^2 - y^2) \text{-----} M1$$

$$= 4(4x + y)(4x - y) \text{-----} A1$$

*Answer*.....  $4(4x + y)(4x - y)$  ..... [2]

**(b)**  $2y + 2 - 5y^2 - 5y$ .

$$2y + 2 - 5y^2 - 5y$$

$$= 2(y + 1) - 5y(y + 1) \text{-----} M1$$

$$= (y + 1)(2 - 5y) \text{-----} A1$$

*Answer* .....  $(y + 2)(2 - 5y)$  ..... [2]**12. A shop is selling \$20.50 for a box of chocolate.**

It offers a 10% discount on the first box of chocolate and a discount of 12% on the second box of chocolate.

**(a)** What is the total cost of the two boxes of chocolate after the discount?

$$\text{Total cost} = \frac{90}{100} \times 20.50 + \frac{88}{100} \times 20.50 \text{-----} M1 \text{ for one discounted box}$$

$$= \$36.49 \text{-----} A1$$

*Answer* \$. ..... 36.49 ..... [2]**(b)** What is the overall percentage discount on the purchase of two boxes of chocolate?

$$\text{Overall discount} = 2(20.5) - 36.49$$

$$= \$4.51 \text{-----} M1$$

$$\text{Percentage discount} = \frac{4.51}{41} \times 100\% = 11\% \text{-----} A1$$

*Answer* ..... 11 ..... % [2]

13. A map is drawn to a scale of 5 cm to 2 km.  
(a) Express the scale of the map in the form of 1 : r.  
5 cm : 200 000 cm  
1 : 40000

Answer .....1: 40 000..... [1]

- (b) The length of a river on the map is 20 cm. Find the actual length of the river in km.  
5 cm to 2 km

Answer .....8.....km [1]

- (c) Find the actual area of a pond if the area on the map is 10 cm<sup>2</sup>.

5 cm to 2 km

Area Scale = 25 cm<sup>2</sup> : 4 km<sup>2</sup> ----- M1

10 cm<sup>2</sup> : 1.6 km<sup>2</sup> ----- A1

Answer .....1.6.....km<sup>2</sup>[2]

14. (a) Construct triangle  $ABC$  where  $BC = 6$  cm and  $AC = 9$  cm.  $AB$  has already been drawn for you.

(b) Measure the reflex angle  $ACB$ .

(c) Construct the

(i) bisector of angle  $ABC$ .

(ii) perpendicular bisector of  $AB$ .

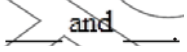
[1]

(d) These two bisectors meet at  $Z$ . Complete the statement below.

[1]

[1]

[1]

The point  $Z$  is equidistant from the lines  and \_\_\_\_\_ and equidistant from the points  and \_\_\_\_\_.

[2]

15. (a) Given that  $x^2 - 9x + 16 = (x + a)^2 + b$ , find  $a$  and  $b$ .

$$x^2 - 9x + 16 = (x - 4.5)^2 - 4.5^2 + 16$$

$$= (x - 4.5)^2 - 4.25$$

Answer  $a = \dots\dots\dots -4.5 \dots\dots\dots$  [1]

$b = \dots\dots\dots -4.25 \dots\dots\dots$  [1]

- (b) Hence, solve  $x^2 - 9x + 16 = 0$ .

$$x^2 - 9x + 16 = 0$$

$$(x - 4.5)^2 - 4.25 = 0$$

$$(x - 4.5)^2 = 4.25$$

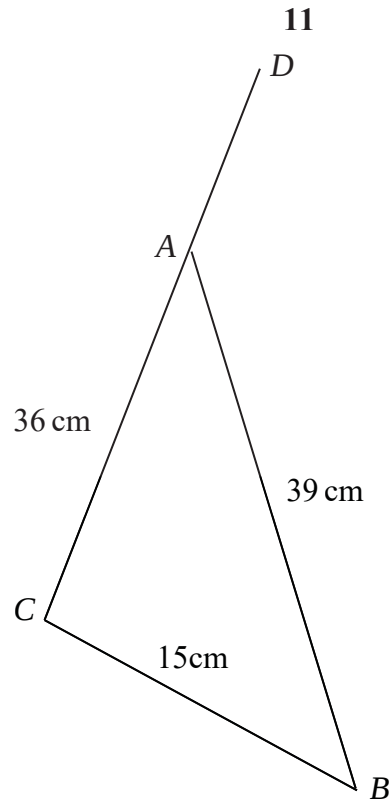
$$x - 4.5 = \pm\sqrt{4.25} \text{ ----- } M1$$

$$x = \pm\sqrt{4.25} + 4.5$$

$$= 6.56 \text{ or } 2.44 \text{ ----- } A1 \text{ each}$$

Answer  $x = \dots\dots\dots 6.56 \text{ or } 2.44 \dots\dots\dots$  [3]

16.



In the triangle  $ABC$ ,  $AB = 39$  cm,  $BC = 15$  cm,  $AC = 36$  cm, and  $CA$  is produced to point  $D$ .

- (a) Determine  $ABD$  is a right angled triangle. [2]

$$AD^2 + BD^2 = 15^2 + 36^2$$

$$= 1521$$

$$AB^2 = 39^2 \neq 1521$$

Since  $AD^2 + BD^2 \neq AB^2$  (M1), by converse of Pythagoras' theorem,  
 $ABD$  is a right angled triangle. (M1)

- (b) Find  $\cos \angle DAB$ .

$$\cos \angle DAB = \frac{36}{39} = -\frac{12}{13}$$

Answer .....  $-\frac{12}{13}$  ..... [1]

- (c) Calculate angle  $ABC$ .

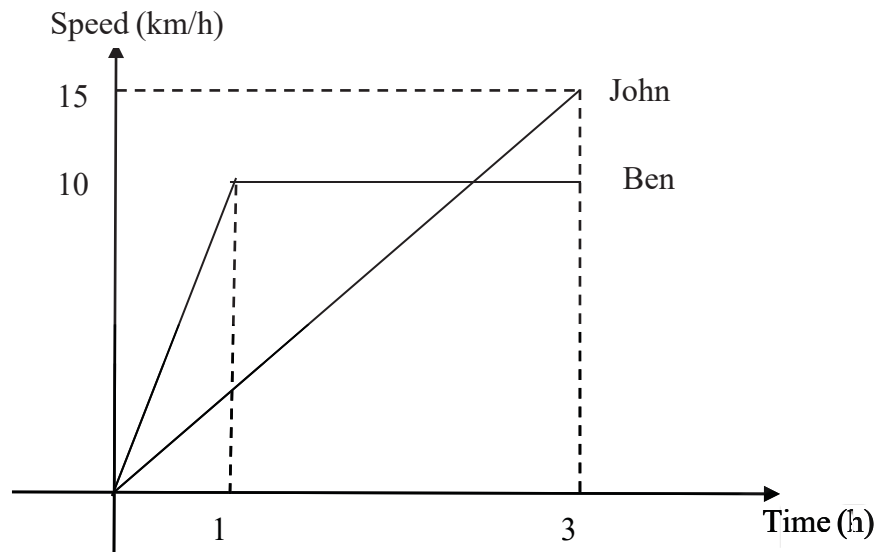
$$\tan \angle ABC = \frac{36}{15} \text{ ----- M1}$$

$$\angle ABC = 67.4^\circ \text{ ----- A1}$$

Answer .....  $74.9^\circ$  ..... [2]



17. The diagram shows the speed-time graph of 2 cyclists, Ben and John from Town A to B.



- (a) Calculate the acceleration of Ben during the first 10 seconds.

$$\frac{10-0}{1} = 10 \text{ km/h}^2$$

Answer .....10.....km/h<sup>2</sup> [1]

- (b) What is John's speed after 1 hour?

$$\frac{\text{speed}}{15} = \frac{1}{3} \text{ ----- M1}$$

$$\text{speed} = 5 \text{ km/h ----- A1}$$

Answer .....5.....km/h [2]

- (c) John has overtaken Ben when he started to cycle faster than Ben.  
Do you agree? Explain and show your working clearly.

Answer .....No (**B1**) because distance travelled by John is 22.5 km and distance travelled by Ben is 25km after 3 hours. John is behind Ben even though he has cycled faster than Ben after 2 hours (**B1**)

18. The graphs below show the charges of 2 taxi companies, Steady Taxi and Reliable Taxi.

- (a) Mr Lee travelled 5 km by Steady Taxi. How much did he have to pay?

Answer \$ .....8.....[1]

- (b) How much would Mr Lee save if he travel by Steady Taxi instead?

Answer \$ .....3.....[1]

- (c) The equation representing the graph for Reliable Taxi is given  $C = p + qD$

where  $C$  is the cost of taxi charges and  $D$  is the distance travelled. Find the value of  $p$  and  $q$ .

$$\text{gradient} = \frac{17-3}{14}$$

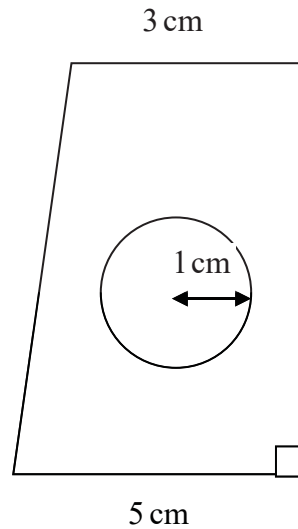
$$= \frac{14}{14} = 1 \text{ ----- B1}$$

Answer  $p = \dots\dots\dots 3 \dots\dots\dots$

$q = \dots\dots\dots 1 \dots\dots\dots$  [2]

- (d) On a particular week, Steady Taxi offers a promo of \$5 off all rides. Draw on the grid above the graph representing the taxi charges for that week. [1]

19. A pendant is made of a trapezium and a circle with radius of 1 cm is cut from the trapezium.



Find

- (a) the area of the circle, (use  $\pi = 3.142$ ),

$$\text{Area} = 3.142 \times 1^2 = 3.14 \text{ cm}^2$$

Answer .....3.14.....cm<sup>2</sup> [1]

- (b) the height if the trapezium given that the area is  $24 \text{ cm}^2$ ,

$$24 = \frac{1}{2} \times (3 + 5) \times \text{height} \text{ ----- M1}$$

$$\text{height} = 6 \text{ cm} \text{ ----- A1}$$

Answer .....6.....cm [2]

- (c) the perimeter of the pendant.

$$\begin{aligned} \text{slant height} &= \sqrt{6^2 + 2^2} \\ &= 6.3245 \text{ ----- M1} \end{aligned}$$

$$\begin{aligned} \text{Perimeter} &= 6.3245 + 3 + 5 + 6 \\ &= 20.3245 \\ &\approx 20.3 \text{ ----- A1} \end{aligned}$$

Answer .....20.3.....cm [2]

20. The following histogram shows the survey findings of students' weekly allowance of a School A.

- (a) Find the number of students in the school.

$$\text{Number of students} = 42 + 43 + 47 + 45 + 42 + 39 \\ = 258$$

Answer .....258.....[1]

- (b) Calculate the percentage of students whose weekly allowance is more than \$17

$$\text{Percentage} = \frac{45 + 42 + 39}{258} \times 100\% \\ = 48.8\%$$

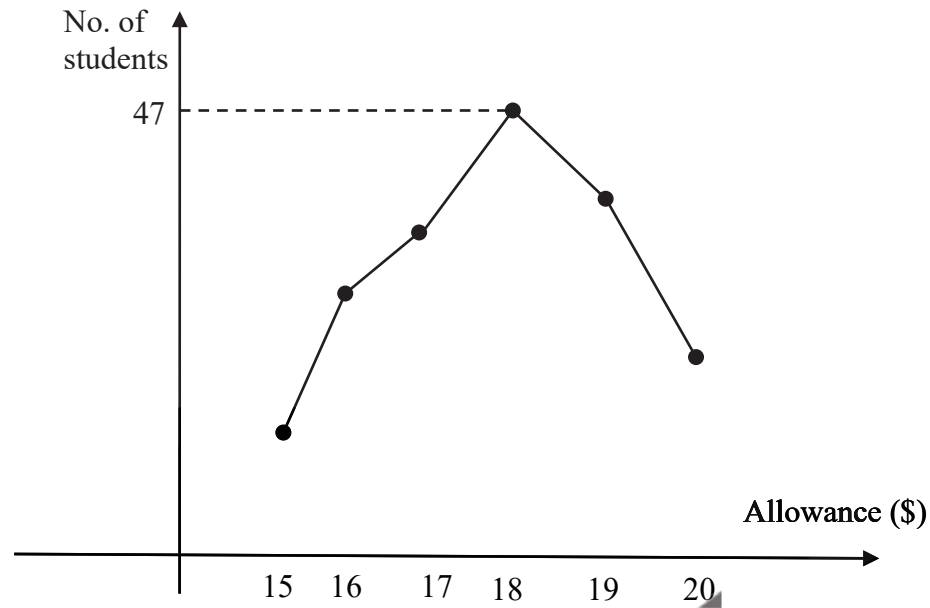
Answer .....48.8.....%, [1]

- (c) Calculate the mean allowance.

$$\text{Mean allowance} = \frac{42 \times 15 + 43 \times 16 + 47 \times 17 + 45 \times 18 + 42 \times 19 + 39 \times 20}{258} \text{ --- M1} \\ = \$17.46 \text{ --- A1}$$

Answer \$.....17.46.....[2]

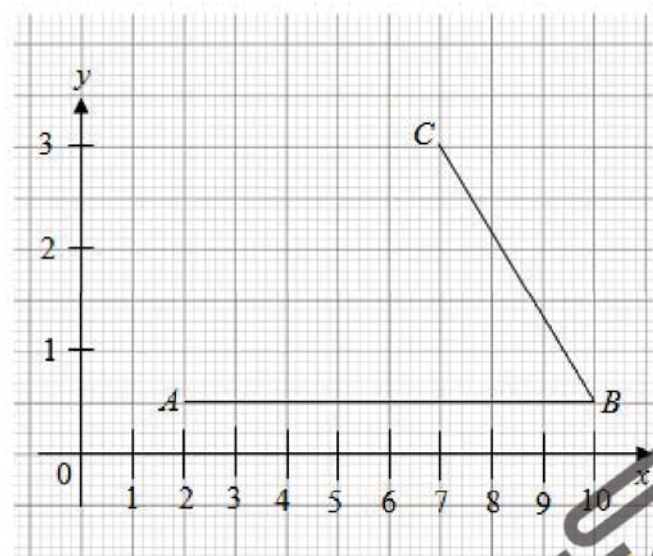
(d)



It is misleading to say that there is a greater **increase** in the number of students in School A than School B from \$16 to \$17. **Explain** why this is so.

*Answer* .....As the scale of the vertical axis is not clear for **School B (B1)**, the increase in number of students between those who have \$16 and \$17 may be larger than School A and thus the increase in School B maybe a greater increase. **(B1)** So it is misleading to say that there is [2] a greater increase in the number of students in school A.

21. The diagram below shows points  $A(2, 0.5)$ ,  $B(10, 0.5)$  and  $C(7, 3)$ .



- (a) Find the equation of the line  $BC$ .

$$\begin{aligned}\text{gradient} &= \frac{3 - 0.5}{7 - 10} \\ &= -\frac{5}{6} \quad \text{--- M1}\end{aligned}$$

$$\text{At } (7, 3),$$

$$3 = -\frac{5}{6}(7) + c$$

$$c = 9\frac{1}{2}$$

$$\text{Equation is } y = -\frac{5}{6}x + 9\frac{1}{2} \quad \text{--- A1}$$

$$\text{Answer..... } y = -\frac{5}{6}x + 9\frac{1}{2} \quad \text{.....[2]}$$

- (b) Find 2 possible coordinates of point  $D$  such that  $A$ ,  $B$ ,  $C$  and  $D$  form the vertices of a parallelogram.

$$\text{Answer ( ..... -1 ..... , ..... 3 ..... )}.$$

$$( ..... 15 ..... , ..... 3 ..... ) [2]$$

- (c) Draw the line  $y = -\frac{1}{2}x + 2$ . [1]

- (e) Hence solve the simultaneous equations  $y = -\frac{1}{2}x + 2$  and  $y = \frac{1}{2}$ .

$$\text{Answer } x = ..... 3 .....$$

$$y = ..... \frac{1}{2} ..... [2]$$



Name:

Register Number:

Class:

**4NA**



**BEDOK GREEN SECONDARY SCHOOL**

**Preliminary Examination 2017**

**4NA**

**MATHEMATICS(Solution)**

**4045/02**

Paper 2

19 July 2017

2 h

Additional Materials :

Answer Paper  
Graph paper ( 1 sheet )

**Section A**

Answer **all** questions.

**Section B**

Answer **one** question.

The number of marks is given in brackets [ ] at the end of each question or part question.  
The total marks for this paper is 60.

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  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

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

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**Total**

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**[Turn Over**



### **Mathematical Formulae**

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

#### *Mensuration*

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

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

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

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

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

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

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

#### *Trigonometry*

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

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

#### *Statistics*

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

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

**Section A (52 marks)**Answer **all** questions.

1. One astronomical unit (AU) is equivalent to 150 gigametres where 1 gigametre =  $1 \times 10^9$  m.
- (a) Express 150 gigametres in metres, giving your answer in standard form. [1]
- (b) Given that the speed of light is  $3 \times 10^8$  m/s, find the number of seconds light takes to travel 3AU. [2]

a)  $150 \text{ gigametres} = 150 \times 10^9$   
 $= 1.5 \times 10^{11} \text{ m} \text{ --- B1}$

b)  $\text{Time} = \frac{3 \times 150 \times 10^9}{3 \times 10^8} \text{ --- M1}$   
 $= 1500 \text{ s} \text{ --- A1}$

---

2. (a) Given that  $V = \frac{Rx}{x+b}$ , express  $x$  in terms of **V, b and R**. [3]
- (b) \$50 is divided in the ratio  $p:q$  where  $p < q$ . Write down an expression in terms of  $p$  and  $q$ , for the bigger amount. [1]

a)  $V = \frac{Rx}{x+b}$   
 $Vx + Vb = Rx \text{ --- M1}$   
 $Vb = Rx - Vx \text{ --- M1}$   
 $Vb = x(R - V)$   
 $x = \frac{Vb}{R - V} \text{ --- A1}$

b) Amount =  $\frac{50q}{p+q} \text{ --- B1}$

---

3. (a) Solve  $5 - \frac{1}{6}(x-4) = 2$ . [2]
- (b) Solve  $x - 6 = \frac{x-9}{x}$ .  
 Give your answers to 3 decimal places. [3]

a)  $5 - \frac{1}{6}(x - 4) = 2$

$$5 - \frac{1}{6}x + \frac{2}{3} = 2 \text{ ----- M1}$$

$$-\frac{1}{6}x = -3\frac{2}{3}$$

$$x = -3\frac{2}{3} \div -\frac{1}{6}$$

$$= 22 \text{ ----- A1}$$

b)  $x - 6 = \frac{x - 9}{x}$

$$x^2 - 6x = x - 9$$

$$x^2 - 7x + 9 = 0 \text{ ----- M1}$$

$$x = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(1)(9)}}{2(1)} \text{ ----- M1}$$

$$= \frac{7 \pm \sqrt{13}}{2}$$

$$= 5.303 \text{ or } 1.687 \text{ ----- A1}$$

4. (a) The diagram shows a kite  $ABCD$ .  $BP$  is parallel to  $AC$ ,  $\angle ABC = 120^\circ$ ,  $\angle PBC = 50^\circ$  and line  $BD$  and  $AC$  meet at point  $E$ . Find, stating the reasons clearly,

- (i)  $\angle BCD$ , [1]  
 (ii)  $\angle ABE$ . [2]

- (b) The monthly wages of 5 employees are listed below:  
 \$5200 \$5000 \$2000 \$5600 \$5600

- (i) Find the median wages. [1]  
 (ii) Explain why median wages is a better reflection of the monthly income of the employees than mean wages. [2]

ai)  $\angle BCD = 50^\circ \times 2$  (diagonal  $AC$  bisects angle  $\angle BCD$ )  
 $= 100^\circ \text{ ----- B1}$

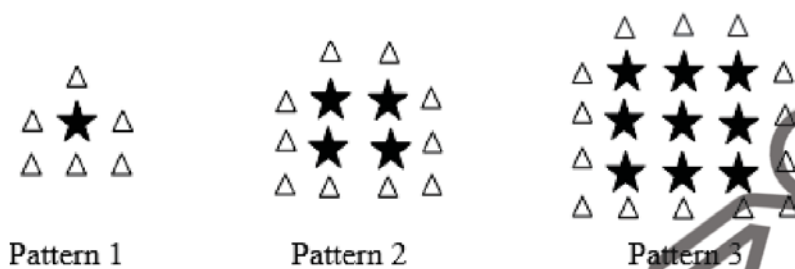
aii)  $\angle EBC = 90^\circ - 50^\circ$  (diagonals intersect at right angles)  
 $= 40^\circ \text{ ----- M1}$

$\angle ABE = 120^\circ - 40^\circ$

$= 80^\circ \text{ ----- A1}$

- bi) Median wages = \$5200  
 ii) Median wages is a better reflection as the value of mean wages is easily affected by outlier value (B1) of \$2000 thus making mean wages an inaccurate measure (B1) of the monthly income of the employees

5. Jaclyn used objects in the shape of triangle and star to make a series of pattern. The first three patterns are as shown below.



The number of objects used in the above patterns are tabulated in the table shown below.

| Pattern Number<br>( $n$ ) | Number of stars<br>( $s$ ) | Number of triangles<br>( $t$ ) |
|---------------------------|----------------------------|--------------------------------|
| 1                         | 1                          | 6                              |
| 2                         | 4                          | 10                             |
| 3                         | 9                          | 14                             |
| 4                         | $a$                        | $b$                            |

- (a) Write down the values of  $a$  and  $b$ . [2]  
 (b) Write down an equation connecting  $n$  and  $s$ . [1]  
 (c) Write down an equation connecting  $n$  and  $t$ . [1]  
 (d) Is there a pattern in the sequence that is made up of 120 triangles? [2]  
 Give an explanation for your answer.

(a)  $a = 16$   
 $b = 18$

(b)  $s = n^2$

(c)  $t = 6 + (n-1)4$

$t = 6 + 4n - 4$

$t = 2 + 4n$

(d)  $120 = 2 + 4n$

$4n = 118$

$n = \frac{118}{4}$

$= 29.5$

No (B1) because value of  $n$  must be a whole number (B1).

6. John is 3 years older than twice the age of his sister, Mary.

- (a) Given that John's age is  $y$  years and Mary's age is  $x$  years, write down an equation in  $x$  and  $y$ . [1]
- (b) If the combined ages of John and Mary is 12 years, write down another equation in  $x$  and  $y$ . [1]
- (c) Solve the pair of simultaneous equations. [3]
- (d) Find the Mary's age in 2 years time. [1]

(a)  $y = 3 + 2x$  ----- B1

(b)  $x + y = 12$  ----- B1

(c)  $x + y = 12$  ----- (1)

$y = 3 + 2x$  ----- (2)

$x + 3 + 2x = 12$  ----- M1

$3x = 9$

$x = 3$  ----- A1

$y = 3 + 2(3)$

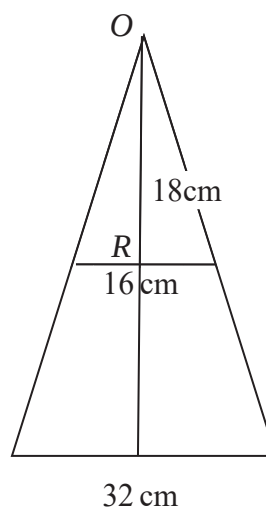
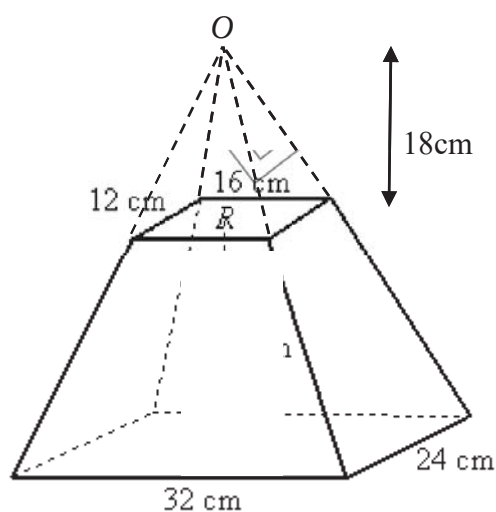
$= 9$  ----- A1

(d) Age in 2 years = 5 years old ----- B1

7. The solid below is obtained when the top portion of a rectangular pyramid is cut off, leaving behind a flat rectangular top of 16 cm by 12 cm and the vertical height of the pyramid cut off,  $RO$  is 18 cm. The dimension of the rectangular base is 32 cm by 24 cm. Find

- (a) the height of the original pyramid. [2]

- (b) the volume of the remaining solid. [2]



Front View of the original pyramid

- (c) To reduce wastage, the pyramid solid that is cut off is then recast into a sphere, find the radius of the sphere. [2]

(a)  $\frac{8}{16} = \frac{18}{\text{height}}$  ----- M1

height = 36 cm ----- A1

(b) Volume of pyramid =  $\frac{1}{3} \times (32 \times 24) \times 36 - \frac{1}{3} \times (12 \times 16) \times 18$  ----- M1  
 = 8460 cm<sup>3</sup> ----- A1

(c)  $\frac{4}{3}\pi r^3 = \frac{1}{3} \times (12 \times 16) \times 18$  ----- M1

$r = 6.50$  cm ----- A1

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

The table below shows some values of  $x$  and the corresponding values of  $y$  for the graph

of  $y = \frac{11}{x} + x - 5$ .

|     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| $x$ | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   |
| $y$ | 7.0 | 2.5 | $q$ | 1.8 | 2.2 | 2.8 | 3.6 | 4.4 |

- (a) Find the value of  $q$ . [1]

- (b) Using the scale of 2 cm to represent 1 unit on each axis, draw the graph of

$y = \frac{11}{x} + x - 5$  for  $1 \leq x \leq 8$ . [3]

- (c) Use your graph to find the values of  $x$  when  $y = 3$ . [1]

- (d) State the coordinates of the minimum point. [1]

- (e) By drawing a tangent, calculate the gradient of the curve at the point  $x = 4$ . [2]

9. James wants to buy a new car on hire purchase and the cash price of the car he wants to buy is \$280 000. He paid a deposit of \$130 000 and takes a loan from the bank to pay for the balance amount.

He is deciding which Car Financing Scheme to use for his loan plan. Below are the interest rates presented to him by the bank for his loan.

| Period of Financing (years) | Simple interest rate per annum (%) | Compound Interest rate per annum (%) |
|-----------------------------|------------------------------------|--------------------------------------|
| 1                           | 3.25                               | 3.5                                  |
| 2                           | 3.25                               | 3.5                                  |
| 3                           | 3.25                               | 3.5                                  |
| 4                           | 3.25                               | 3.5                                  |
| 5                           | 3.25                               | 3.5                                  |
| 6                           | 3.25                               | 3.5                                  |
| 7                           | 3.5                                | 3.7                                  |
| 8                           | 3.5                                | 3.7                                  |
| 9                           | 3.5                                | 3.7                                  |
| 10                          | 3.5                                | 3.7                                  |

There are 2 financing schemes available. The total amount of loan will be paid in monthly instalments throughout the loan period.

There are 2 financing schemes available. The total amount of loan will be paid in monthly instalments throughout the loan period.

Details of the 2 schemes are as follows:

**Scheme A**

He can repay his loan in 10 years using the simple interest rate.

**Scheme B**

He can repay his loan in 10 years using the compound interest rate.

You can opt for an early repayment in this scheme where in the event you decide to repay the outstanding loan before the loan period ends. You will receive a rebate on the interest due to the early repayment.

Early repayment is allowed after 6 years of loan payment in monthly instalments. The balance of the loan must be paid in full and you will also receive a rebate which can be deducted from the loan. The rebate is calculated using the formula below:

$$\text{Rebate} = \frac{n(n+1)}{N(N+1)} \times TC \times 80\%$$

where:

$n$  represents the balance loan period in months

$N$  represents the original loan period in months

$TC$  represents the total amount of interest payable over the original loan period

- (a) Calculate the hire purchase price of the car if James use Scheme A for a loan period of 10 years.

- (b) Calculate the hire purchase price of the car if James use Scheme B for a loan period of 10 years without early repayment. [2]
- (c) Given that James has a budget of \$2000 per month to pay his monthly instalment, justify if both schemes in (a) and (b) are within his monthly budget. Show your working clearly. [2]
- (d) James is considering an early repayment for Scheme B which he can deduct the rebate from his loan amount. Justify which scheme would he choose if early repayment is a possible option for him. Show your working clearly. [2]

(a)

$$\text{Balance} = 280000 - 130000 = 150000$$

$$\text{interest} = \frac{150000 \times 10 \times 3.5}{100}$$

$$= \$52500 \text{ ----- M1}$$

$$\text{Hire Purchase price} = 280000 + 52500$$

$$= \$332500 \text{ ----- A1}$$

(b)

$$\text{Total amount with interest} = 150000 \left(1 + \frac{3.7}{100}\right)^{10}$$

$$= \$215714.24 \text{ ----- M1}$$

$$\text{Hire Purchase price} = 130\,000 + 215714.24$$

$$= \$345714.24 \text{ ----- A1}$$

c)

$$\text{Monthly instalment for scheme A} = \frac{150000 + 52500}{10 \times 12}$$

$$= \$1687.50 \text{ ----- M1}$$

$$\text{Monthly instalment for scheme B} = \frac{215714.24}{10 \times 12}$$

$$= \$1797.62 \text{ ----- M1}$$

Therefore both schemes are within his budget. (2 marks given when justification statement given)



d)

$$\begin{aligned}
 \text{Rebate} &= \frac{48(48+1)}{120(120+1)} \times (215714.24 - 150000) \times 0.8 \\
 &= \frac{2352}{14520} \times 65714.24 \times 0.8 \\
 &= \$8515.69 \text{ ----M1}
 \end{aligned}$$

$$\begin{aligned}
 \text{Total Hire purchase price for scheme B} &= 345714.24 - 8515.69 \\
 &= \$337198.55
 \end{aligned}$$

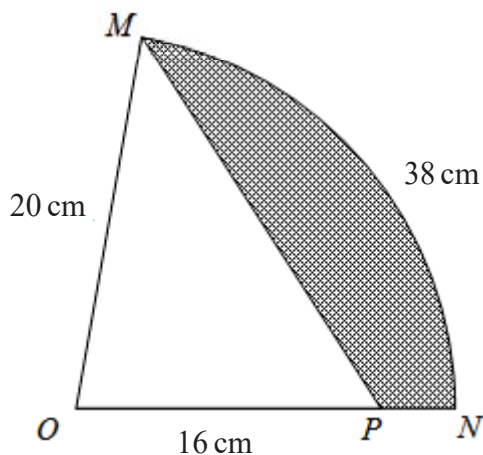
James would choose Scheme A as the hire purchase price for Scheme B is still higher than Scheme A despite the early repayment. ----A1 given only if hire purchase price of B is calculated and attempt to explain the reason.

### Section B (8 marks)

Answer any 1 question from this section. Each question carries 8 marks.

10. A, B and C are three cones placed on a soccer field. C is 60 m due east of A. B is 33 m from C, and on a bearing of 055° from A.  $\angle ACB$  is obtuse.

- (a) (i) Find the bearing of A from B. [1]
- (ii) Find the angle ABC. [2]
- (ii) Given that a player runs along AB, how far does he need to run from A such that he is closest to C? [2]
- (b) In the diagram, MON is a sector of a circle, centre O and radius 20 cm, and the length of the arc MN is 38 cm. P is a point on ON such that OP = 16 cm.



Find

(i)  $\angle MON$ , in radians. [1]

(ii) the perimeter of the shaded region. [2]

$$\text{ai) } 180^\circ + 55^\circ = 235^\circ$$

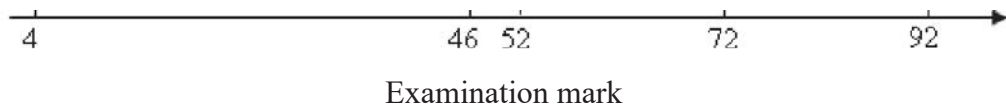
$$\begin{aligned} \text{aii) } \frac{33}{\sin 35^\circ} &= \frac{50}{\sin \angle ABC} \text{-----} M1 \\ \angle ABC &= \sin^{-1}\left(\frac{50 \sin 35^\circ}{33}\right) \\ &= 60.3^\circ \text{-----} A1 \end{aligned}$$

$$\begin{aligned} \text{aiii) } \cos 35^\circ &= \frac{\text{distance}}{50} \text{-----} M1 \\ \text{distance} &= 50 \cos 35^\circ \\ &= 41.0 \text{ m} \text{-----} A1 \end{aligned}$$

$$\begin{aligned} \text{bi) } \text{angle } \angle MON &= \frac{38}{20} \\ &= 1.9 \text{ rad} \text{---} B1 \end{aligned}$$

$$\begin{aligned} \text{bii) } MP^2 &= 20^2 + 16^2 - 2(20)(16) \cos 1.9 \\ MP &= 29.375 \text{---} M1 \\ \text{Perimeter} &= 29.375 + 4 + 38 \text{-----} M1 \\ &= 71.4 \text{ m} \text{---} A1 \end{aligned}$$

11. (a) The box-and-whiskers diagram below shows the marks of 40 students in Secondary 4A in a common test.



(i) State the median mark. [1]

(ii) Find the inter-quartile range. [1]

(iii) Two students are chosen at random from the group. Find the probability that both students score more than or equal to 72 marks but less than 92 marks. [2]

- (b) The cumulative frequency graph shows the distribution of the marks of the entire Secondary 4 cohort in the same common test.



- (i) Find the interquartile marks of the whole cohort. [1]
- (ii) Calculate the passing mark if 45% of the cohort pass. [1]
- (iii) Secondary 4A is said to have done better compared to the rest of the cohort.  
Do you agree? Give your reasons clearly. [2]

ai) 52 marks

ii) 26 marks

$$\begin{aligned} \text{iii) Probability} &= \frac{10}{40} \times \frac{9}{39} \text{ --- } M1 \\ &= \frac{3}{52} \text{ --- } A1 \end{aligned}$$

bi) 30 marks

ii) 48 marks

iii) Yes (**B1**) as class 4A has a **higher median mark (B1)** compared to the rest of the cohort.

*End of paper*