

Visit
FREETESTPAPER.com
for more papers



Website: freetestpaper.com



[Facebook.com/freetestpaper](https://www.facebook.com/freetestpaper)

Calculator Model: **4NA**

CANDIDATE NAME: _____ ()

CLASS: _____

CENTRE
NUMBER

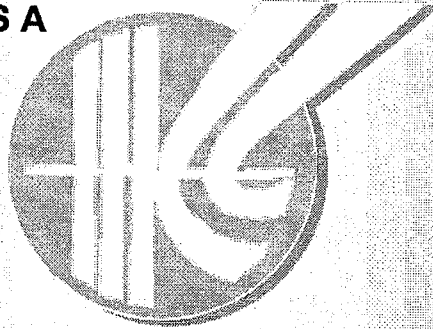
S				
---	--	--	--	--

INDEX
NUMBER

--	--	--	--

KRANJI SECONDARY SCHOOL
Preliminary Examination
Secondary 4 Normal Academic

MATHEMATICS SYLLABUS A
 Paper 1

4045/01

Thursday

26 July 2018

2 hours

KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI
 KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI
 KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number and name on all the work you hand in.

Write in dark blue or black pen.

You may use a HB pencil for any diagrams or graphs.

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

Answer **all** questions.

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

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

Omission of essential working will result in loss of marks.

The total of the marks for this paper is 80.

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 your answers in degrees to one decimal place.

For π , use either your calculator value or 3.142.

For Examiner's Use**Total****80**

Setter: Mr Heng Kee Kiat

This question paper consists of **18** printed pages, including the cover page.

[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** the questions.

1. Esther makes a fruit drink using strawberry juice, lemonade and orange juice.
 The ratio strawberry juice: lemonade is 2 : 5.
 The ratio lemonade: orange juice is 3 : 5.
 Find the ratio strawberry juice : lemonade : orange juice.

Answer : : [1]

2. Petrol cost x cents per litre. Patrick buys some petrol and it costs him y dollars.
 Find an expression, in terms of x and y , for the number of litres that Patrick buys.

Answer litres [1]

3. Given that y is inversely proportional to x^3 and that $y = 8$ for a particular value of x .
 Find the value of y when the particular value of x is reduced by 50%.

Answer $y =$ [2]

4. Simplify, leaving your answers in postive index form,

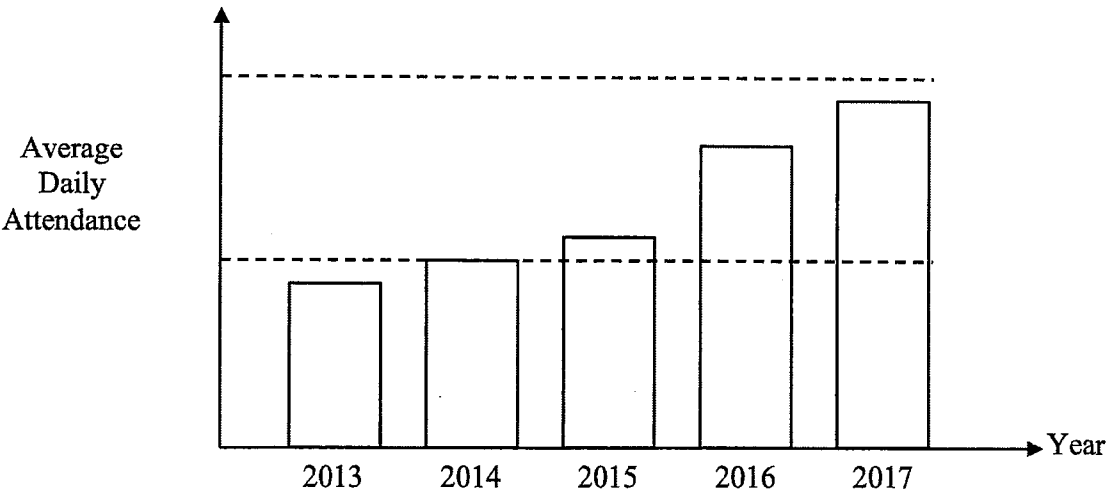
(a) $p^2q \times p^5q^{-2}$,

Answer [1]

(b) $\left(\frac{27}{x^{15}}\right)^{\frac{1}{3}}$.

Answer [1]

5. The graph shows the average daily attendance for a school over a number of years.



State one feature of the chart that may be misleading and explain why.

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

6. One solution of $2x^2 + kx - 15 = 0$ is $x = -5$.
Find

(a) the value of k ,

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

(b) the other solution of the equation.

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

7. (a) Calculate $\frac{12.6^3}{17.1 - 3.56}$. Write down the first 5 digits on your calculator display.

Answer $\dots\dots\dots$ [1]

(b) Write your answer to part (a) correct to 2 significant figures.

Answer $\dots\dots\dots$ [1]

8. Given that $s = ut + \frac{1}{2}at^2$, express a in terms of s , u and t .

Answer [2]

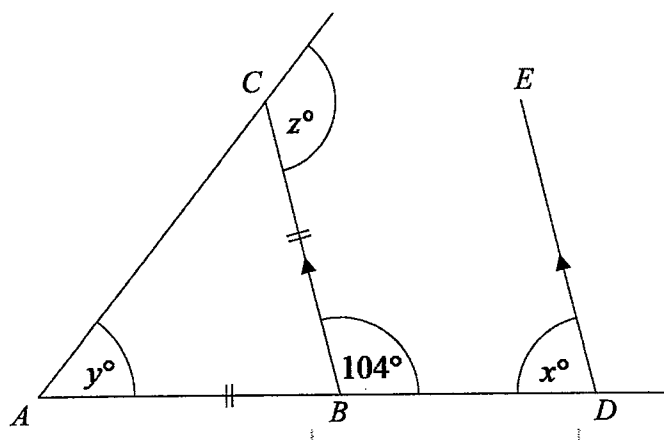
9. Mandy can paint 7 chairs in 5 hours.
 Alice can paint 5 chairs in 4 hours.
 Mandy and Alice work together to paint a total of 17 chairs.
 Assuming that they continue to paint at the same rate, how long will it take them to paint 17 chairs?
 Give your answer in hours and minutes, to the nearest minute.

Answer hmin [2]

10. A polygon has n sides. Two of its exterior angles is 45° , while the other remaining exterior angles are 30° each. Find the value of n .

Answer [3]

11. In the diagram, ABC is a triangle in which $AB = BC$. The point D is on AB produced such that DE is parallel to BC .



Given that angle $CBD = 104^\circ$, calculate

- (a) x ,

Answer $x =$ [1]

- (b) y ,

Answer $y =$ [1]

- (c) z .

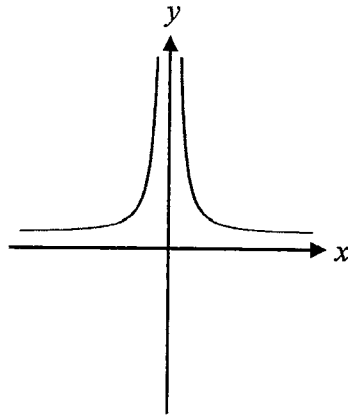
Answer $z =$ [1]

12.

$y = 7^x$	$y = -x^{-2}$	$y = 7 - x^3$
$y = x^{-2}$	$y = x^3 + 7$	$y = 7^{-x}$

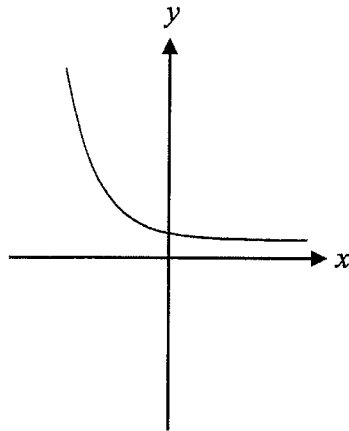
Write down a possible equation for each of the sketch graphs below.
In each case select one of the equations from the box above.

(a)



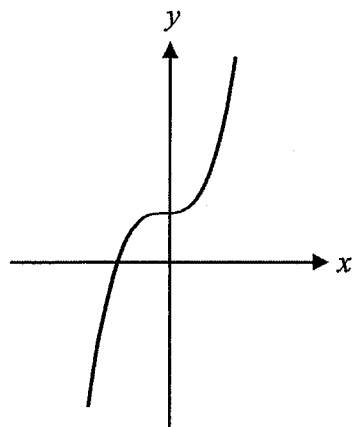
Answer [1]

(b)



Answer [1]

(c)



Answer [1]

13. (a) Simplify $4p - 3(2 - 3p)$.

Answer [1]

- (b) Factorise completely $6as - 4br - 3bs + 8ar$.

Answer [2]

14. Written as a product of its prime factors, $5400 = 2^p \times 3^3 \times 5^q$.

- (a) Find the values of p and q .

Answer $p =$

$q =$ [2]

- (b) Find the smallest positive integer k such that $\frac{5400}{k}$ is a cube number.

Answer $k =$ [1]

15. (a) Given that $7^m = 7^4 \times \frac{1}{7} \times 7^0$, find m .

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

- (b) Given that $3^{k+1} = 27^{1-k} \times 81$, find k .

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

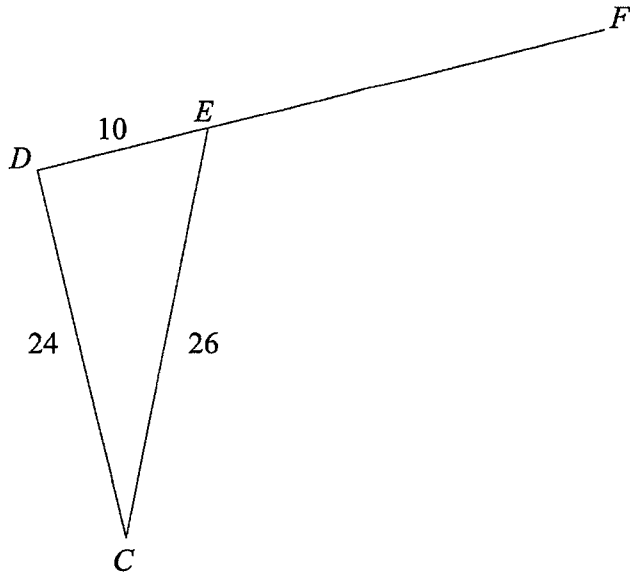
16. (a) Factorise completely $27a^2 - 12$.

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

- (b) Hence simplify $\frac{27a^2 - 12}{3a^2 + 4a - 4}$, such that $a \neq \frac{2}{3}, -2$.

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

17. In the diagram, $CD = 24$ cm, $DE = 10$ cm and $CE = 26$ cm and DEF is a straight line.



- (a) Explain why angle CDE is a right angle.

Answer

.....

..... [2]

- (b) Write as a fraction, in its simplest form,

- (i) $\sin \angle ECD$,

Answer [1]

- (ii) $\cos \angle CEF$.

Answer [1]

18. The line $2x - 5y = 20$ crosses the x -axis at A and the y -axis at B .
Find the

(a) gradient of the line,

Answer [1]

(b) coordinates of point A and point B ,

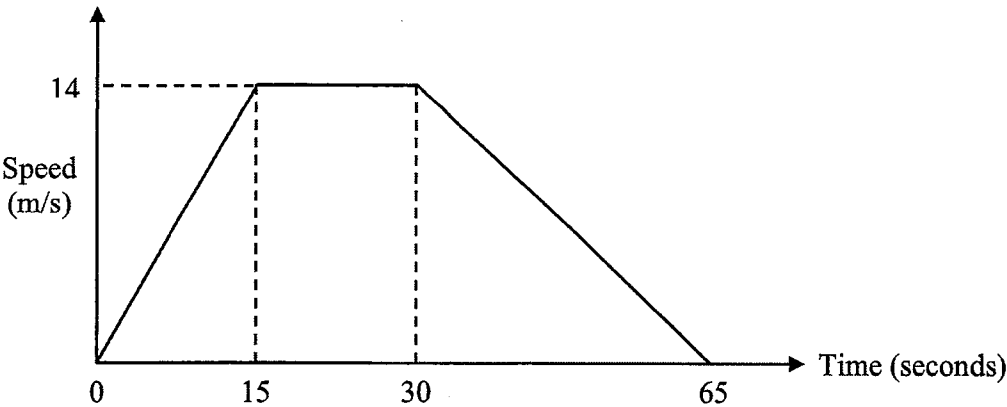
Answer A (.....,)

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

(c) area of triangle OPB , where O is the origin and P is $(5, 4)$.

Answerunits² [1]

19. The diagram shows the speed-time graph for a car journey between two road junctions.



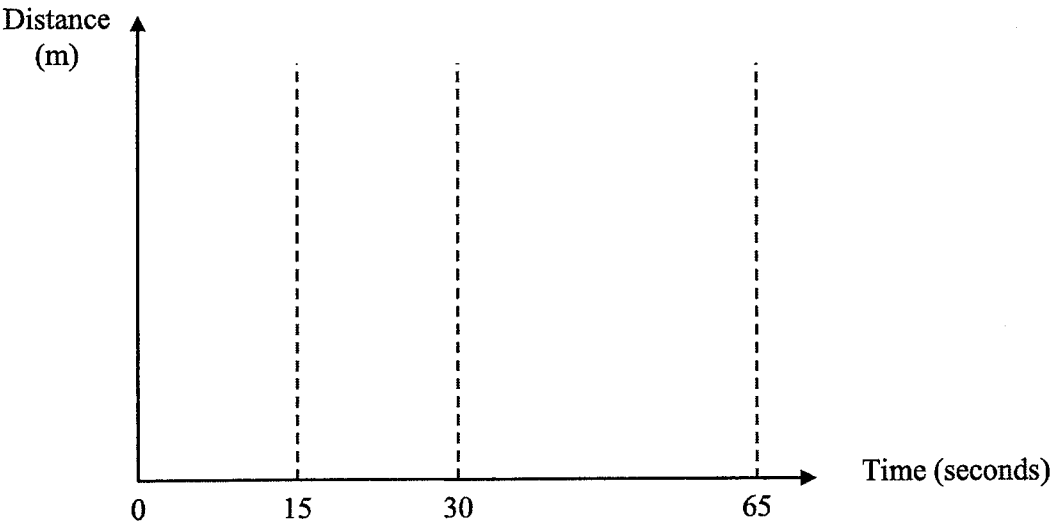
(a) Find the acceleration of the car after 10 seconds.

Answer m/s^2 [1]

(b) Explain what happens to the car from $t = 15$ to $t = 30$.

Answer
..... [1]

(c) Use the grid below to sketch the distance-time graph for the journey.



[3]

20. Matthew bought 28 erasers and pencils altogether for \$17.90 in a bookshop. He bought x erasers at 30 cents each and y pencils at 80 cents each.

(a) Form two equations involving x and y .

Answer

..... [2]

(b) Hence, solve the simultaneous equations from (a) to find the number of erasers and pencils Matthew bought.

Answer erasers

..... pencils [3]

21. A waterfall has a width of 4828 m.

(a) Write 4828 in standard form.

Answer [1]

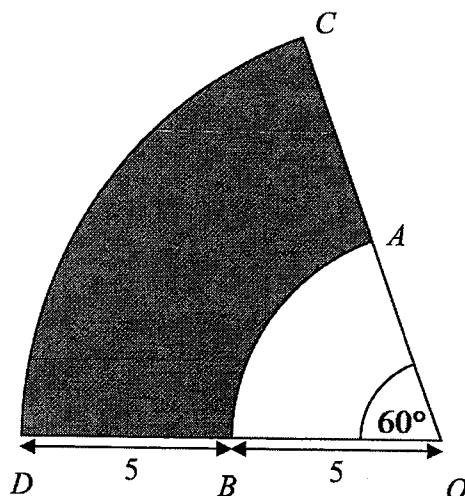
(b) The average volume of water flowing over another waterfall is 7.91×10^3 litres per second. After a rainstorm the volume of water increased to 2.15×10^4 litres per second. Calculate the percentage increase in the volume of water flowing over the waterfall.

Answer% [2]

(c) The average volume of water flowing over a third waterfall is 1.70×10^3 litres per second. Calculate the volume of water flowing over the waterfall in one hour. Give your answer in standard form, correct to 2 significant figures.

Answer cm^3 [2]

22. The diagram shows the arcs AB and CD of two circles, centre O , with radii 5 cm and 10 cm respectively.



OAC and OBD are straight lines and angle $COD = 60^\circ$.
Calculate

- (a) the perimeter of the shaded region, giving your answer in the form of $a + b\pi$,

Answer cm [2]

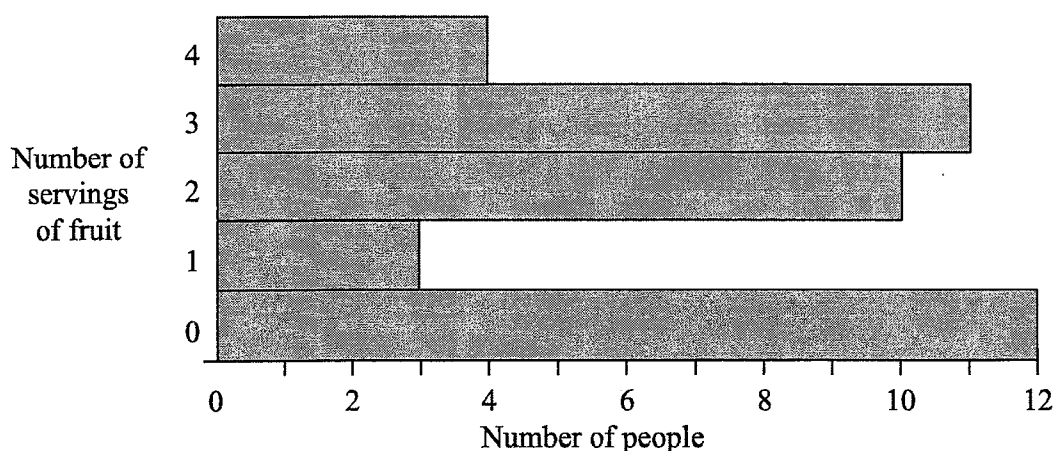
- (b) the area of the shaded region, giving your answers as a multiple of π ,

Answer cm^2 [3]

- (c) the ratio of the area of the shaded region to the area of the sector AOB .
Give your answer in the form of $m : n$ where m and n are integers.

Answer : [1]

23. Brighton asked 40 people how many servings of fruit they ate the previous day. The chart summaries the results.



- (a) Complete the table.

Number of servings of fruit	Number of people
0	12
1	3
2	
3	
4	

[1]

- (b) Find the mode.

Answer [1]

- (c) Find the median.

Answer [1]

- (d) Calculate the mean.

Answer [2]

- (e) Explain why the mode is not a good measure of average in this case.

Answer
 [1]

24. A developer bought a triangular piece of land, ABC , where $AB = 100$ m, $AC = 110$ m and $BC = 120$ m.
- (a) Using a scale of 1 cm to represent 10 metres, construct an accurate scale drawing of the plan of the land, with AC as the horizontal base. [3]
- (b) The developer intends to build a children's playground on the land at location P which is equidistant from AB , BC and CA . Find and label the position of P . [2]
- (c) Find actual distance of AP .

Answer $AP = \dots\dots\dots$ m [1]

~ End of Paper ~

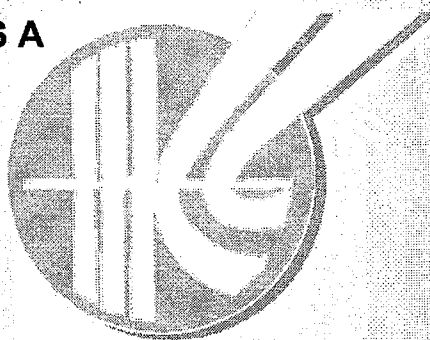
Calculator Model: _____

4NA

Name: _____ () Class: _____

KRANJI SECONDARY SCHOOL
Preliminary Examination
Secondary 4 Normal Academic

MATHEMATICS SYLLABUS A
 Paper 2

4045/02

Friday

27 July 2018**2 hours**

KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI
 KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI
 KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI SECONDARY KRANJI

READ THESE INSTRUCTIONS FIRST

An answer booklet will be provided with this question paper. You should follow the instructions on the front cover of the answer booklet. If you need additional answer paper ask the invigilator for a continuation booklet.

Section AAnswer **all** questions.**Section B**Answer **one** question.

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

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

Omission of essential working will result in loss of marks.

The total of the marks for this paper is 60.

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 your answers in degrees to one decimal place.

For π , use either your calculator value or 3.142.

Setter: Mr Heng Kee Kiat

This question paper consists of 9 printed pages, including the cover page.

[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

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

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

Section A (52 marks)

Answer all the questions in this section.

1. (a) Express $x^2 + 2x - 15$ in the form $(x + a)^2 + b$. [2]

- (b) Answer part (b) on lined paper.

Sketch the graph of $y = x^2 + 2x - 15$.

Do **not** make an accurate plot but show, on your sketch, the coordinates of the point where the value of y is a minimum. [2]

2. (a) The first three terms in a sequence of numbers, $T_1, T_2, T_3, \dots$ are given below.

$$T_1 = 1^2 + 1 = 2$$

$$T_2 = 2^2 + 3 = 7$$

$$T_3 = 3^2 + 5 = 14$$

- (i) Find T_4 . [1]

- (ii) Find, an expression, in terms of n , for T_n . [1]

- (b) Mary invests \$4000 for 5 years compounded 1.18% per year. How much is the investment worth at the end of the five years? [2]
-

3. (a) Solve the inequality $\frac{3-2x}{2} > 3(x-4)$. [2]

- (b) Represent the above solution using a number line. [1]

- (c) Hence, or otherwise, state the greatest integer of x which satisfies

$$\frac{3-2x}{2} > 3(x-4). \quad [1]$$

4. (a) Solve the equation $\frac{3x}{7} - \frac{1}{3}x = 4$. [2]

(b) Write as a single fraction in its simplest form $\frac{3x}{(2x-1)^2} - \frac{2}{2x-1}$. [3]

5. (a) The cost of a budget flight was reduced from \$580 to \$458.
Calculate the reduction as a percentage of the original cost. [2]

(b) Brighton holds a credit card issued by Bank of Singapore Limited. He plans to get a watch during his business trip to Japan. He has two options, to either purchase in Singapore or in Japan.

Option A:

Buy in Singapore Changi Airport
Departure Hall

Cost : \$21209.35

Option B:

Buy in Japan

Cost : ¥1 800 000

Pay by credit card: 5% discount

Tourist: additional 3% discount

Credit card administrative fee: 1.5%

The credit card company uses an exchange rate between Singapore dollars (\$) and yen (¥) of \$1 = ¥80.38.

Which option should he take? Justify your answer with workings. [4]

6. Diagram I shows a barn and Diagram II shows the cross-section of its end.

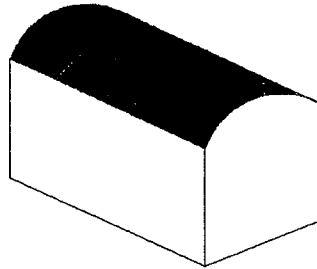


Diagram I

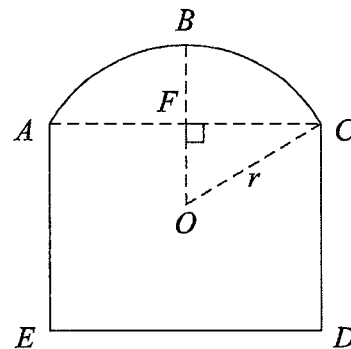


Diagram II

A farmer needs to order a new roof for his barn.

The roof is represented by ABC , the arc of a circle of radius r , centre O .

$ACDE$ is a rectangle. The farmer measures AC , CD , BF and the length of the barn.

- (a) Given that $AC = 8$ m and $BF = 2$ m,
- Write down an expression, in terms of r , for the length of OF . [1]
 - Show that the radius, r , of the circle is 5 m. [3]
- (b) Show that angle AOC is approximately 106° . [2]
- (c) Given that the length of the barn is 12 metres, calculate the curved area of the roof. [2]
-

7. A man travels a total distance of 166 km. His average speed for the first 130 km is x km/h, and the remaining journey, $(x-25)$ km/h. The whole journey takes 3 hours and 15 minutes.
- (a) Write an expression in terms of x ,
- (i) the time taken for the first 130 km. [1]
- (ii) the time taken for the remaining journey. [1]
- (b) Form an equation in x and show that it reduces to $13x^2 - 989x + 13000 = 0$. [3]
- (c) Solve this equation and find the value of x .
Give your answers correct to 1 decimal place. [3]
-

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

Maggie recorded the mass of her new baby every 7 days.

The table below shows some of the values she recorded.

Age of baby (t days)	0	7	14	21	28	35	42	49	56	63	70
Mass (m kg)	3.35	3.10	3.00	3.00	3.25	3.55	3.95	4.35	4.75	5.10	5.35

- (a) Using a scale of 2 cm to represent 10 days, draw a horizontal t -axis for $0 \leq t \leq 70$.
Using a scale of 4 cm to represent 1 kg, draw a vertical m -axis for $2 \leq m \leq 6$.
On your axes, plot the points given in the table and join them with a smooth curve. [3]
- (b) Use your graph to estimate when the baby regained its birth mass. [1]
- (c) (i) By drawing a tangent, find the gradient of the curve at $(7, 3.10)$. [2]
- (ii) What does this gradient represent? [1]
-

9. Mae plans to supply 75 cupcakes per month to a cake shop for period of six months. Below shows the recipe of the individual components for making 15 cupcakes.

<u>Chocolate Cupcakes</u>		<u>Chocolate Fudge Frosting</u>	
50 g	cocoa powder	120 g	unsweetened chocolate
175 g	all purpose flour	150 g	unsalted butter
6 g	baking powder	160 g	powdered sugar
113 g	unsalted butter		
200 g	granulated sugar		
2	eggs		

The table below shows the breakdown of the individual components from a local supermarket and wholesaler.

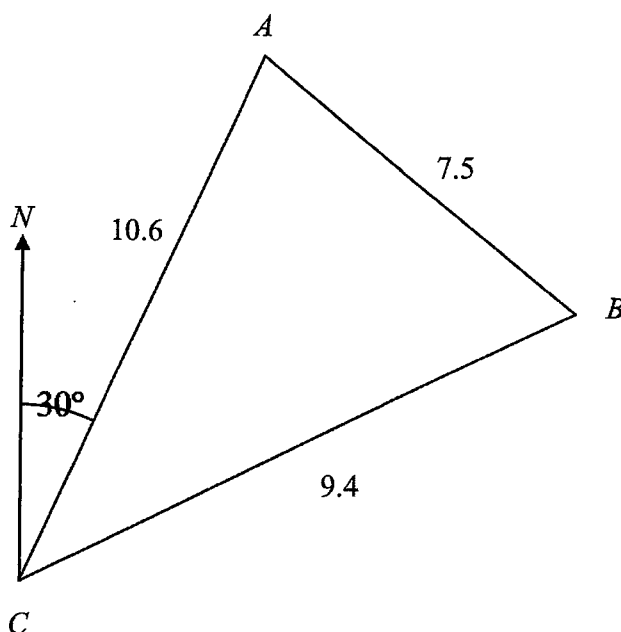
Item	Weight	Unit Cost
All purpose flour	1000 g	\$2.30
Unsalted butter	250 g	\$3.50
	1000 g	\$12.50
Baking powder	226 g	\$3.15
Eggs (expires in a month)	10 per pack	\$2.50
	15 per pack	\$3.50
	30 per pack	\$4.45
Granulated sugar	1000 g	\$1.55
	3000 g	\$4.15
Powdered sugar	500 g	\$1.75
	1000 g	\$2.50
Cocoa powder	250 g	\$4.10
	500 g	\$7.00
Unsweetened chocolate	500 g	\$7.80
	1000 g	\$13.75
Cupcake cases	50 pcs	\$3.25
	100 pcs	\$5.50

- (a) Find the cost of butter used for 1 month. [1]
- (b) Suggest a sensible amount for her to charge the cake shop for the supply of cupcakes for six months. [5]
- Justify the decision you make and show your calculations clearly.

Section B (8 marks)

Answer only one question in this section.
Each question carries 8 marks.

10. In the diagram, A , B and C are three points on a horizontal ground.
 $AC = 10.6$ m, $BC = 9.4$ m and $AB = 7.5$ m.
The bearing of A from C is 030° .



Calculate

- | | |
|--|-----|
| (a) the bearing of B from C , | [3] |
| (b) the area of triangle ABC . | [2] |
| (c) the shortest distance from A to BC . | [1] |

At a certain instant, a bird is at T , which is vertically 23 m above A .

Calculate

- | | |
|---|-----|
| (d) the angle of depression of B from T . | [2] |
|---|-----|

11. (a) A bag contains 7 blue and 8 red balls.

Two balls are taken from the bag at random, one after the other, without replacement.

- (i) Draw a tree diagram to show the probabilities of the possible outcomes. [2]
 (ii) Find, as a fraction in its simplest form, the probability of drawing at least 1 blue ball. [2]

- (b) The table shows the weights of 20 boys.

Weight (x kg)	Frequency
$55 \leq x < 60$	2
$60 \leq x < 65$	7
$65 \leq x < 70$	8
$70 \leq x < 75$	3

Calculate an **estimate** for

- (i) the mean weight of the boys, [2]
 (ii) the standard deviation of their weights. [2]

~ End of Paper ~

2018 4NA PRELIMS PAPER 1 ANSWER SCHEME

1. $2 : 5 = 6 : 15$
 $3 : 5 = 15 : 25$
 strawberry juice : lemonade : orange juice = 6 : 15 : 25
-

2. x cents --- 1 litres
 $100y$ cents --- $\frac{100y}{x}$ litres
-

3. $y = \frac{k}{x^3} \Leftrightarrow k = x^3 y$

$k = 8x^3$ for a particular x

$$y = \frac{k}{\left(\frac{1}{2}x\right)^3}$$

$$y = \frac{8x^3}{\frac{1}{8}x^3} = 64$$

4. (a) $p^2 q \times p^5 q^{-2} = \frac{p^7}{q}$

(b) $\left(\frac{144}{x^{18}}\right)^{\frac{1}{3}} = \frac{3}{x^6}$

5. Attendance (Vertical axis) did not clearly states that it starts from zero.
 Hence comparing the heights may be misleading and inaccurate for the attendance rate such as 2017 is twice of 2013.
 (any other possible reasons)
-

$$\begin{aligned}
 6. \quad (a) \quad & 2(-5)^2 + k(-5) - 15 = 0 \\
 & 50 - 15 = 5k \\
 & k = 7
 \end{aligned}$$

$$\begin{aligned}
 (b) \quad & 2x^2 + 7x - 15 = 0 \\
 & (2x - 3)(x + 5) = 0 \\
 & x = -5 \text{ (NA)} \text{ or } x = 1\frac{1}{2}
 \end{aligned}$$

$$7. \quad (a) \quad 147.74$$

$$(b) \quad 150$$

$$8. \quad s = ut + \frac{1}{2}at^2$$

$$\frac{1}{2}at^2 = s - ut$$

$$a = \frac{2(s - ut)}{t^2}$$

$$9. \quad \text{Mandy + Alice paint } \frac{7}{5} + \frac{5}{4} = \frac{53}{20} \text{ chairs in one hour.}$$

$$\begin{aligned}
 \text{Time taken to paint 17 chairs} &= 17 \div \frac{53}{20} \\
 &= 6 \text{ h } 25 \text{ min}
 \end{aligned}$$

$$10. \quad 2 \times 45^\circ + (n - 2) \times 30^\circ = 360^\circ$$

$$30(n - 2) = 270^\circ$$

$$n - 2 = 9$$

$$n = 11$$

$$11. \quad (a) \quad x = 180 - 104 = 76$$

$$(b) \quad y = 104 \div 2 = 52$$

$$(c) \quad z = 52 + 76 = 128$$

12. (a) $y = x^{-2}$ B1
 (b) $y = 7^{-x}$ B1
 (c) $y = x^3 + 7$ B1
-

13. (a) $4p - 3(2 - 3q) = 13p - 6$
 (b) $6as - 4br - 3bs + 8ar$
 $= 2a(3s + 4r) - b(3s + 4r)$
 $= (3s + 4r)(2a - b)$
-

14. (a) $5400 = 2^3 \times 3^3 \times 5^2$
 $p = 3, q = 2$
 (b) $k = 25$
-

15. (a) $m = 3$
 (b) $3^{k+1} = 27^{1-k} \times 81$
 $3^{k+1} = 3^{3(1-k)} \times 3^4$
 $k + 1 = 3 - 3k + 4$
 $k = \frac{3}{2}$
-

16. (a) $27a^2 - 12 = 3(9a^2 - 4)$
 $= 3(3a - 2)(3a + 2)$
 (b) $\frac{27a^2 - 12}{3a^2 + 4a - 4} = \frac{3(3a - 2)(3a + 2)}{3a^2 + 4a - 4}$
 $= \frac{3(3a - 2)(3a + 2)}{(3a - 2)(a + 2)}$
 $= \frac{3(3a + 2)}{(a + 2)}$
-

17. (a) $DE^2 + DC^2 = 10^2 + 24^2 = 676 = 26^2 = CE^2$
Hence by converse of Pythagoras' Thm, triangle CDE is a right-angled triangle with angle CDE as the right angle.

(b) (i) $\sin \angle ECD = \frac{10}{26} = \frac{5}{13}$

(ii) $\cos \angle CEF = -\frac{10}{26} = -\frac{5}{13}$

18. (a) gradient = $\frac{2}{5}$

(b) $A(10,0), B(0,-4)$

(c) area = $\frac{1}{2}(4)(5) = 10 \text{ units}^2$

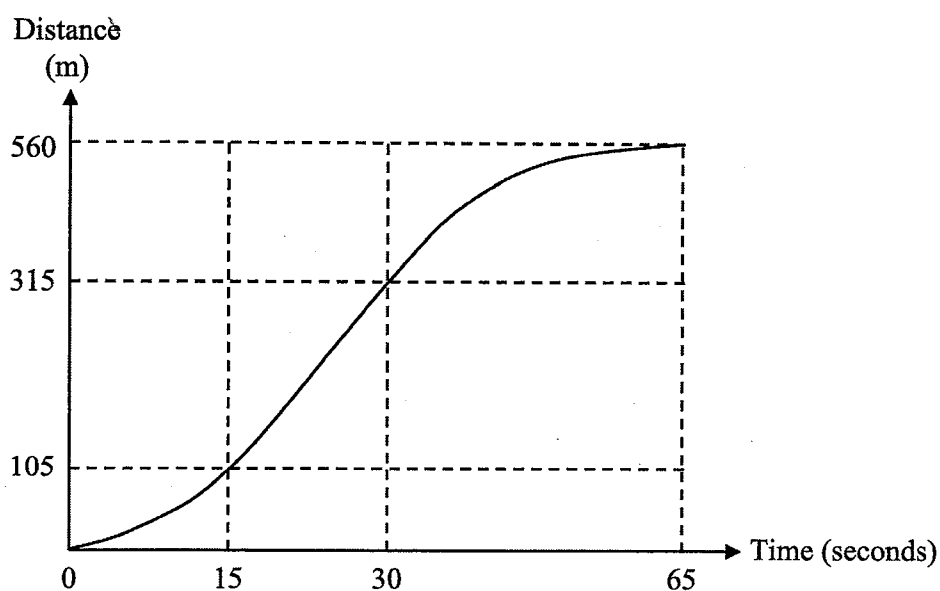
19. (a) acceleration = $\frac{14}{15} \text{ m/s}^2$ or 0.933 m/s^2

(b) car is travelling at a constant speed of 14 m/s

(c) distance from 0-15s = $\frac{1}{2} \times 15 \times 14 = 105 \text{ m}$

distance from 15-30s = $15 \times 14 = 210 \text{ m}$

distance from 30-65s = $\frac{1}{2} \times 35 \times 14 = 245 \text{ m}$



20. (a) $x + y = 28$ (1)

$$30x + 80y = 1790$$

$$3x + 8y = 179 \quad (2)$$

$$0.3x + 0.8y = 17.9$$

(b) Subst (1) $y = 28 - x$ into (2)

$$3x + 8(28 - x) = 179$$

$$x = 9 \quad (\text{erasers})$$

$$y = 19 \quad (\text{pencils})$$

21. (a) 4.828×10^3

(b) percentage increase

$$= \frac{2.15 \times 10^4 - 7.91 \times 10^3}{7.91 \times 10^3} \times 100\%$$

$$= 172\% \quad (3 \text{ s.f.})$$

(c) volume of water in one hour

$$= 1.7 \times 10^3 \times 60 \times 60$$

$$= 6.1 \times 10^6 \text{ cm}^3$$

$$22. \quad (a) \quad \text{arc } AB = \frac{60}{360} \times 2 \times \pi \times 5 = \frac{5}{3} \pi$$

$$\text{arc } CD = \frac{10}{3} \pi$$

$$\begin{aligned} \text{perimeter of shaded area} &= 10 + \frac{5}{3} \pi + \frac{10}{3} \pi \\ &= 10 + 5\pi \text{ cm} \end{aligned}$$

$$(b) \quad \text{area of sector } OAB = \frac{60}{360} \times \pi \times 5^2 = \frac{25}{6} \pi$$

$$\text{area of sector } OCD = \frac{100}{6} \pi$$

$$\begin{aligned} \text{area of shaded area} &= \frac{100}{6} \pi - \frac{25}{6} \pi \\ &= \frac{25}{2} \pi \text{ cm}^2 \end{aligned}$$

$$(c) \quad \text{area of shaded region : area of the sector } AOB = 3 : 1$$

$$23. \quad (a) \quad 12, 10, 11, 4$$

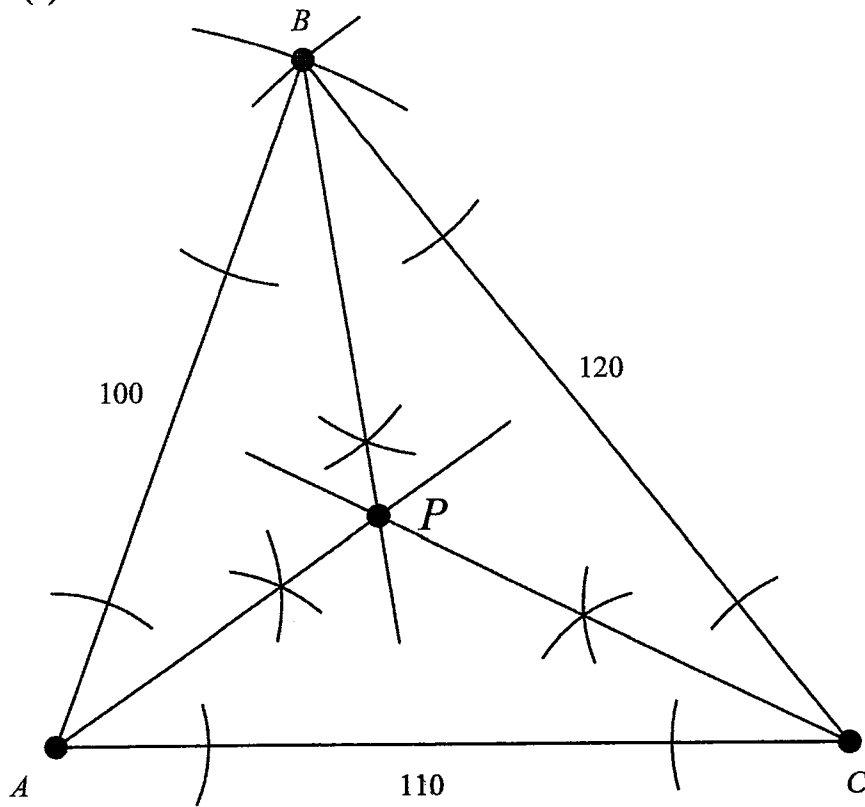
$$(b) \quad \text{mode} = 0$$

$$(c) \quad \text{median} = 2$$

$$\begin{aligned} (d) \quad \text{mean} &= \frac{0 \times 12 + 1 \times 3 + 2 \times 10 + 3 \times 11 + 4 \times 4}{40} \\ &= \frac{72}{40} \\ &= 1.8 \text{ servings of fruits} \end{aligned}$$

$$(e) \quad \text{It is very far from mean and median. (extreme values)}$$

24. (a)



(b) Draw 3 angle bisectors
Label P

(c) $AP = 5.48 \times 10 = 54.8\text{m}$

~ END OF PAPER ~

2018 4NA PRELIMS PAPER 2 ANSWER SCHEME

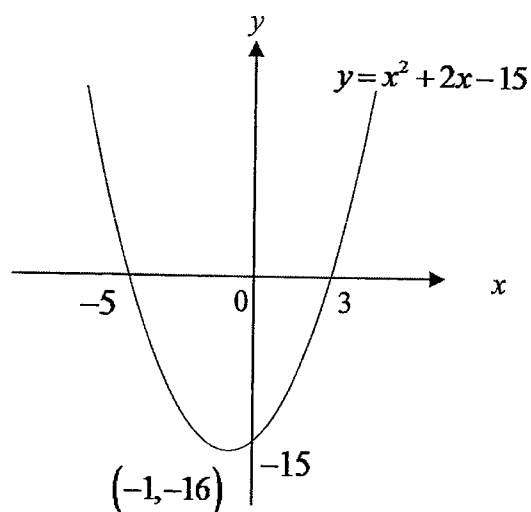
1. (a) $x^2 + 2x - 15 = (x+1)^2 - 16$

(b) Axes Intercept:

$$y = 0 \quad x = 3, -5$$

$$x = 0 \quad y = -15$$

Turning point @ $(-1, -16)$ min



2. (a) (i) $T_4 = 4^2 + 7 = 23$

(ii) $T_n = n^2 + 2n - 1$

(b) investment worth $= 4000 \left(1 + \frac{1.18}{100} \right)^5$
 $\approx \$4241.64$

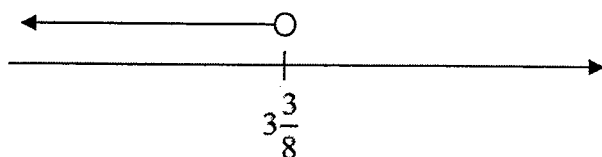
3. (a) $\frac{3-2x}{2} > 3(x-4)$

$$3-2x > 6x-24$$

$$8x < 27$$

$$x < 3\frac{3}{8}$$

(b)



(c) largest integer = 3

$$\begin{aligned}
 4. \quad (a) \quad & \frac{3x}{7} - \frac{1}{3}x = 4 \\
 & \frac{9x}{21} - \frac{7x}{21} = 4 \\
 & \frac{2x}{21} = 4 \\
 & x = 42
 \end{aligned}$$

$$\begin{aligned}
 (b) \quad & \frac{3x}{(2x-1)^2} - \frac{2}{2x-1} = \frac{3x-2(2x-1)}{(2x-1)^2} \\
 & = \frac{3x-4x+2}{(2x-1)^2} \\
 & = \frac{2-x}{(2x-1)^2}
 \end{aligned}$$

$$\begin{aligned}
 5. \quad (a) \quad \% \text{ reduction} &= \frac{580-458}{580} \times 100\% \\
 &= \frac{122}{580} \times 100\% \\
 &\approx 21.0\%
 \end{aligned}$$

(b) Option A:
price before GST = \$21209.35

Option B:
Price after additional discount
= ¥1800000 × 0.95 × 0.97
= ¥1658700

administrative fee (¥)
= ¥1658700 × $\left(1 + \frac{1.5}{100}\right)$
= ¥1683580.50

conversion price
= $\frac{1683580.50}{80.38} = \20945.27

Cheaper to buy in Japan

6. (a) (i) $OF = r - 2 \text{ cm}$

(ii) $OF^2 + FC^2 = OC^2$
 $(r-2)^2 + 4^2 = r^2$
 $r^2 - 4r + 4 + 16 = r^2$
 $4r = 20$
 $r = 5 \text{ (shown)}$

(b) $\angle FOC = \sin^{-1} \frac{4}{5}$ or $\cos^{-1} \frac{3}{5}$ or $\tan^{-1} \frac{4}{3}$

$\angle AOC = 2 \sin^{-1} \frac{4}{5}$
 $\angle AOC = 106.260...^\circ \approx 106^\circ$

(c) arc length $ABC = \frac{106.260...}{360} \times 2 \times \pi \times 5$
 $= 9.27295...$

curved area of the roof $= 9.27295... \times 12$
 $\approx 111 \text{ m}^2$

7. (a) (i) time taken for first 130 km $= \frac{130}{x} \text{ h}$
(ii) time taken for remaining $= \frac{36}{x-25} \text{ h}$

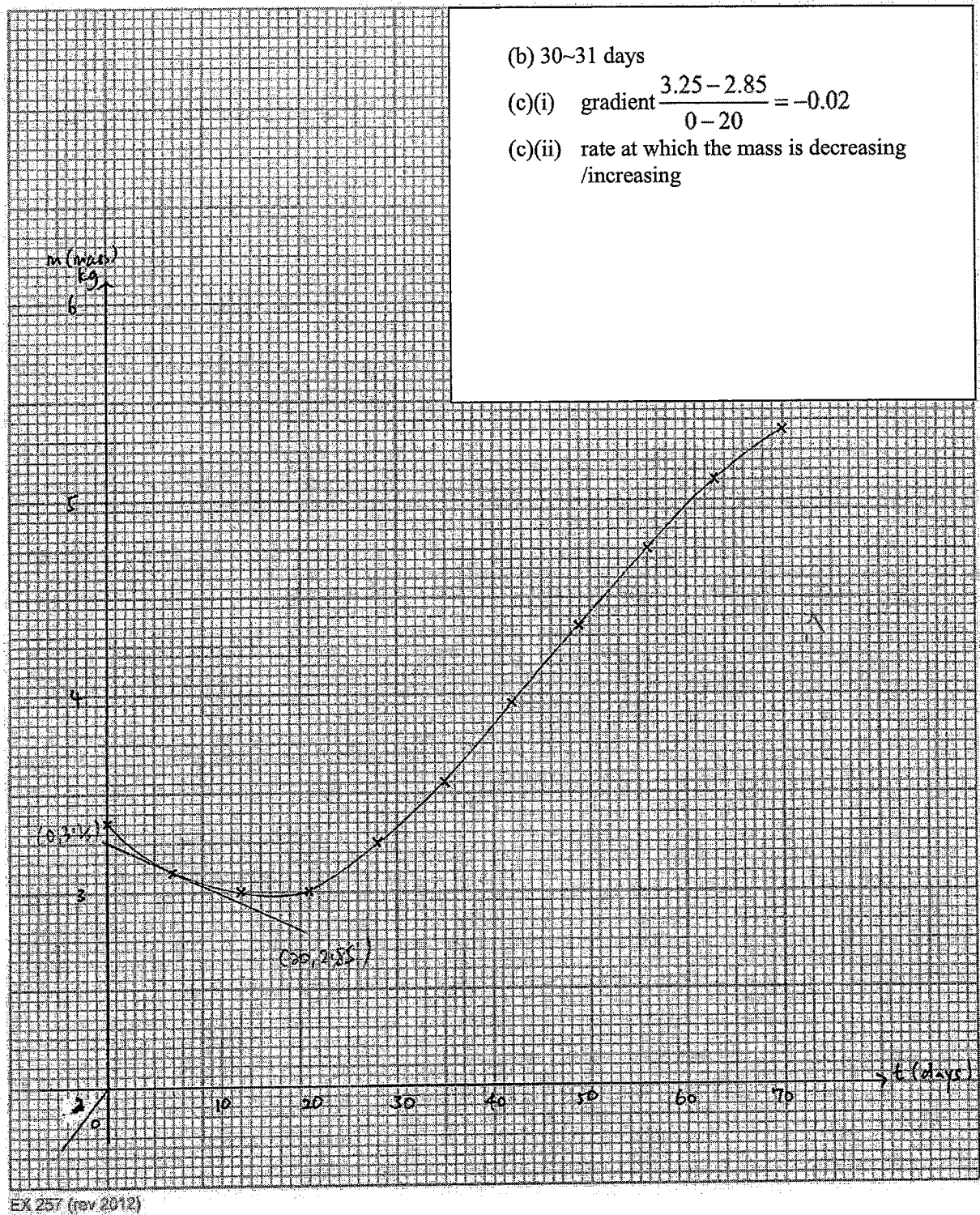
(b) $\frac{130}{x} + \frac{36}{x-25} = \frac{13}{4}$
 $130 \times 4(x-25) + 36 \times 4x = 13x(x-25)$
 $520x - 13000 + 144x = 13x^2 - 325x$
 $13x^2 - 989x + 13000 = 0 \text{ (shown)}$

(c) $x = \frac{-(-989) \pm \sqrt{(-989)^2 - 4(13)(13000)}}{2(13)}$

$x = \frac{989 \pm \sqrt{302121}}{26}$

$x \approx 16.9 \text{ (NA)} \quad 59.2$

8. Graph



9. (a) amt of butter used for 15 cupcakes = $113 + 150 = 263$ g
 amt of butter used for 75 cupcakes = $263 \times 5 = 1315$ g

$$\text{Cost of butter per month} = 12.50 + 2 \times 3.50 = \$19.50$$

$$\text{Or} \quad = \frac{1315}{1000} \times 12.50 = \$16.44$$

Possible answers: \$19.50, \$18.41, \$16.44

- (b) Any combination based on 1 month or 6 months

Recommended answer
 \$243.76 ~ \$350

Based on 1/6 month(s) (students exhibit)

M1 calculate the total amount used for ingredients

M1 calculate the total cost for respective ingredients

M1 calculate the total cost for 75/450 cupcakes

A1 suggest a possible charge

A1 justify the charge (labour charge, utilities bills, etc)

- (*) candidates **must use** 10 eggs per pack due to expiry date
 follow through candidates' reasonable workings

If all correct except wrong use of egg price award 4 marks for (b)

(b)

Duration (month)	1		for 1 month		6	for 6 months	
Recipe	15	75	Least	Max	450	Least	Max
cocoa powder	50	250	\$4.10	\$4.10	1500	\$21.00	\$24.60
all purpose flour	175	875	\$2.01	\$2.30	5250	\$12.08	\$13.80
baking powder	6	30	\$0.42	\$3.15	180	\$2.51	\$3.15
unsalted butter	263	1315	\$18.41	\$21.00	7890	\$98.63	\$112.00
granulated sugar	200	1000	\$1.55	\$1.55	6000	\$8.30	\$9.30
Eggs (*)	2	10	\$2.50	\$2.50	60	\$15.00	\$15.00
unsweetened chocolate	120	600	\$9.36	\$15.60	3600	\$49.50	\$62.40
powdered sugar	160	800	\$2.80	\$3.50	4800	\$12.00	\$17.50
cupcake cases	15	75	\$4.88	\$6.50	450	\$24.75	\$29.25
Total			\$46.03	\$60.20		\$243.76	\$287.00

(b) For one month (75 cupcakes)

$$\text{amt of flour} = \frac{175}{1000} \times 2.30 = 0.4025$$

$$\text{amt of cocoa} = \frac{50}{500} \times 7.00 = 0.70$$

$$\text{no. of eggs} = \frac{2}{10} \times 2.50 = 0.5$$

$$\text{amt of baking powder} = \frac{6}{226} \times 3.15 = 0.08362...$$

$$\text{amt of butter} = \frac{263}{1000} \times 12.50 = 3.2875$$

$$\text{amt of chocolate} = \frac{120}{1000} \times 13.75 = 1.65$$

$$\text{amt of powdered sugar} = \frac{160}{1000} \times 2.50 = 0.40$$

$$\text{no. of cupcake cases} = \frac{15}{100} \times 5.50 = 0.825$$

$$\text{amt of granulated sugar} = \frac{200}{3000} \times 4.15 = 0.2766...$$

Basic cost for 15 cupcakes

$$= 0.4025 + 0.70 + 0.50 + 0.08362 + 3.2875 + 1.65 + 0.4 + 0.825 + 0.27666$$

$$= 8.125$$

Estimated cost for 6 months (5 portions $\times$ 6 months) worth of cupcakes

$$= 8.125 \times 5 \times 6$$

$$= \$243.75$$

Suggested pricing = \$280

Reason:

Hidden costs such as utilities, manpower to be factored in.

$$10. \quad (a) \quad \cos C = \frac{10.6^2 + 9.4^2 - 7.5^2}{2(10.6)(9.4)}$$

$$C = 43.534\dots^\circ$$

$$\text{Bearing of } B \text{ from } C = 30^\circ + 43.534\dots^\circ = 073.5^\circ$$

$$(b) \quad \text{area of triangle } ABC = \frac{1}{2}(10.6)(9.4)\sin 43.534\dots^\circ$$

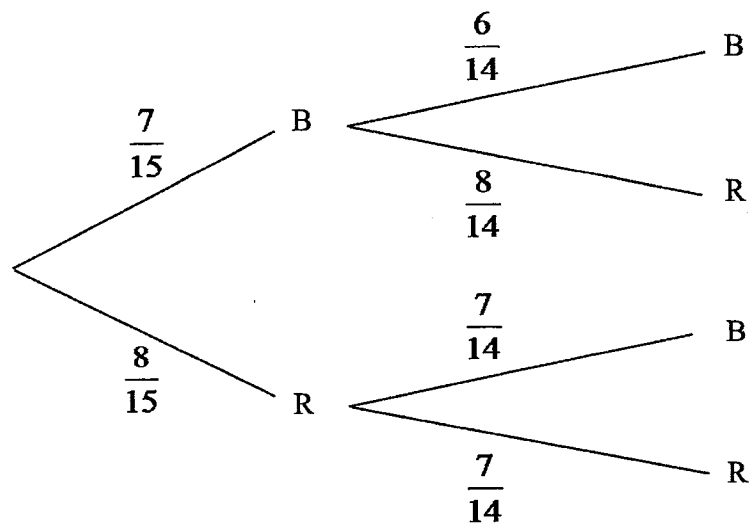
$$\approx 34.3 \text{ m}^2$$

$$(c) \quad \text{shortest distance} = (10.6)\sin 43.534\dots^\circ \approx 7.30 \text{ m}$$

$$(c) \quad \text{angle of depression} = \tan^{-1} \frac{23}{7.5}$$

$$\approx 71.9^\circ$$

11. (a) (i)



$$\begin{aligned}
 \text{(ii) } P(\text{at least one blue ball}) &= 1 - \frac{8}{15} \times \frac{7}{14} \\
 &= \frac{11}{15}
 \end{aligned}$$

$$\text{(b) (i) } \sum x = 1310$$

$$\text{mean} = \frac{1310}{20} = 65.5 \text{ kg}$$

$$\text{(ii) } \sum x^2 = 86175$$

$$\text{std deviation} = \sqrt{\frac{86175}{20} - \left(\frac{1310}{20}\right)^2}$$

$$\approx 4.30 \text{ kg}$$

