Canberra Grammar School

RMC CLW1 GLL JXA JEZH KRA
BCW EZI

Name: _____

2024
Advanced Mathematics Year 10

Final Exam

General Instructions

- Reading time: 5 minutes
- Working time: 1 hour 45 minutes
- Write using a black or blue pen.
- All working must be shown.
- All answers must be fully simplified.
- An approved scientific calculator may be used during the test.
- A Reference Sheet is provided.

Mark allocation

- Multiple Choice – 10 marks
  Allow about 10 minutes
- Section 1 & 2 (Short answers) – 82 marks
  Allow about 1 hour 35 minutes
- Total marks: 92 marks

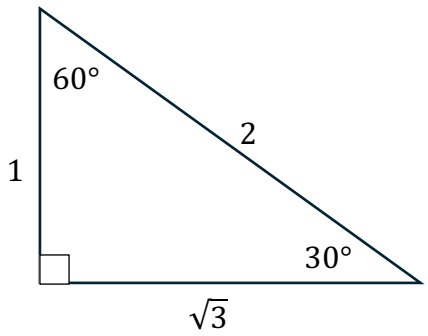
Section	MC	Section 1				Section 2				
Question	1 – 10	LR	Prob	Ind & Surds	F&P	NL	Trig	Stats	PS	TOTAL
Out of	10	11	7	7	9	13	15	10	10	92
Mark										

Task setter: GLL

Multiple Choices (10 marks)
Allow about 10 minutes for this part

- Circle the alternative A, B, C or D that best answers the question
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1. From the diagram which statement is correct?



(A) $\cos 30° = \frac{1}{2}$

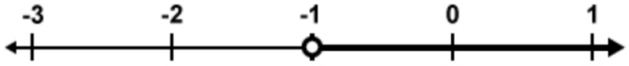
(B) $\tan 60° = \frac{1}{\sqrt{3}}$

(C) $\sin 60° = \frac{\sqrt{3}}{2}$

(D) $\sin 30° = \frac{1}{\sqrt{3}}$

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2. What is the correction solution to the inequality shown on the number line below?



(A) $x \leq -1$

(B) $-1 < x \leq 1$

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3. Simplify $(4a^5)^2$

(A) $8a^7$

(B) $4a^{10}$

(C) $16a^7$

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4. The solution/s to the equation $(x + 2)^2 = 16$ are:

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(B) $2 \ or - 6$

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(D) $4 \ or - 4$

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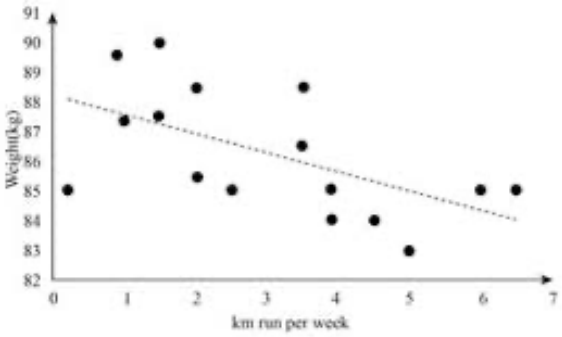
(B) Median or Mode

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6. Which of the following is best used to describe the correlation between the variable x and y in this scatter plot?



(A) A strong, positive correlation

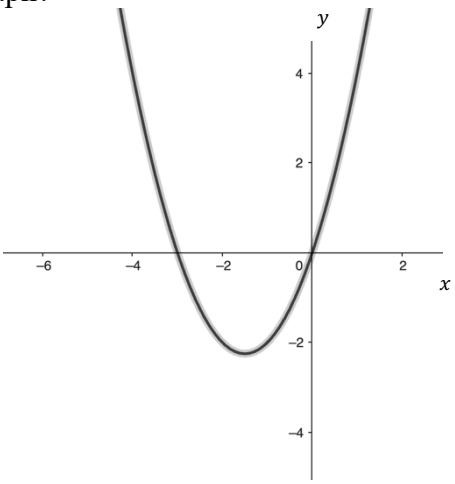
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7. What is a possible equation for this graph?



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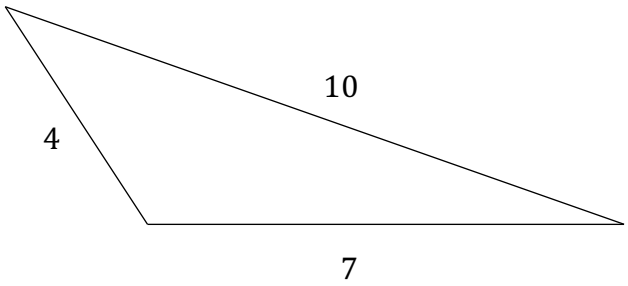
(B) $y = x^2 - 3x$

(C) $y = x(x + 3)$

(D) $y = -x^2 - 3x$

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8. Which of these formulas is used to calculate the **smallest** angle θ in the triangle below?



(A) $\cos\theta = \frac{4^2+7^2-10^2}{2\times4\times7}$

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9. Five bags of sand are placed in order from the lightest to the heaviest.
The heaviest bag weighs 25 kg, the median weight of the five bags is 16 kg and the mode weight is 12 kg. If the mean weight of the bags is 17 kg, what is the weight (kg) of the second heaviest bag?

(A) 18

(B) 19

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(D) 22

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10. There are n tennis balls in a box of which one is orange and the rest are white. Two of the balls are randomly selected from the box without replacement. What is the probability that both of the selected balls are white?

(A) $\frac{1}{n}$

(B) $\frac{n-2}{n}$

(C) $\frac{n-1}{n}$

(D) $\frac{n-1}{n-2}$

SECTION 1

Linear Relations (11 marks)

1. Solve $3(2x + 5) = 4 - x$

   Show clear algebraic working. **(3 marks)**

2. Simply: $\frac{7x}{3} - \frac{2x-1}{9}$ **(3 marks)**

3. Point $A(1, -22)$ and point $B(5, -2)$ together form a line ***AB***.

(a) Show that the equation of line **AB** is $y = 5x - 27$ **(2 marks)**

(b) Line **L** has an equation $3x + 2y = -2$. Use simultaneous equations to find the point of intersection between line **L** and line **AB.** **(3 marks)**

Probability (7 marks)

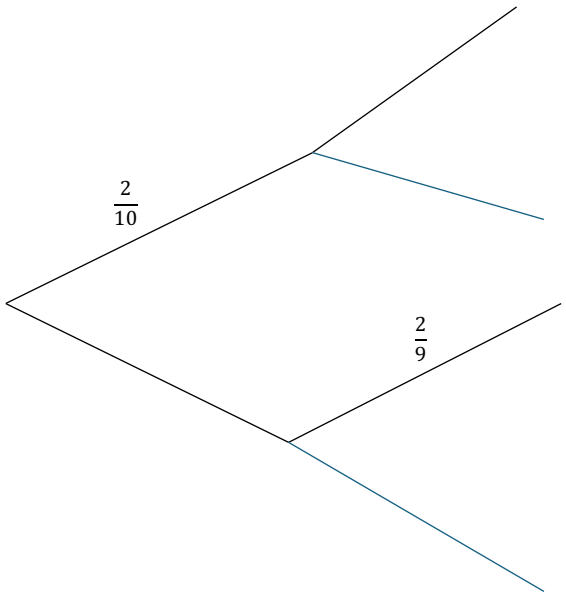
4. Each letter in the word EQUILATERAL is written on a separate card. These cards are then placed face down on a table.

   What is the probability that a card containing a letter A or E is randomly turned over?

   (1 mark)

5. Raphael does not like strawberry flavoured chocolates. In a dark cinema during a film, Raphael selects two chocolates at random without replacement from a box. There are 10 chocolates in the box. Of these chocolates, 2 are strawberry flavoured and 8 are plain chocolate.

   (a) Represent this information by completing the tree diagram below **(2 marks)**

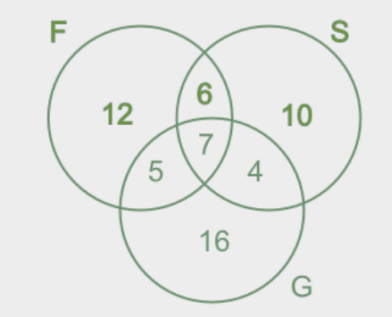


   (b) What is the probability that Raphael selects **at least** 1 strawberry flavoured chocolate? **(2 marks)**

6. The Venn diagram shows students that are studying a language subject (French, Spanish and German).

   (a) What is the probability of a student studying all three subjects? **(1 mark)**

   (b) What is the probability of a student studying all three subjects, given that they are studying at least two subjects? **(1 mark)**



Indices and Surds (7 marks)

7. Use the index laws to fully simplify

$$\frac{(-5x^0y^6)^2}{y^4}$$ **(2 marks)**

8. Simplify by first rationalising the denominator **(2 marks)**

$$\frac{1+\sqrt{3}}{2\sqrt{3}}$$

9. Rachael invests $8000 in a savings account for 4 years. The savings account pays compound interest at a rate of:

    4.5% p.a. for the first year

    2.75% p.a. for the next three years

(a) How much will Rachael's investment be worth at the end of the first year? **(1 mark)**

(b) How much will Rachael's investment be worth at the end of 4 years if interest is compounded yearly?(answer correct to the nearest cent)

(2 marks)

Factors and Products (9 marks)

10. Fully factorise the following:

(a) $y^2 - 100x^2$

(2 marks)

(b) $6m^2 + m - 2$ **(2 marks)**

11. Simplify $\frac{p^2+2p-15}{p^2-3p}$ by first factorising the numerator and denominator

(3 marks)

12. Consider a person throwing a baseball from ground level. The baseball will reach its peak height and fall back to the ground. At time t (in seconds), the height h (in metres) from the ground is given by $h = -t^2 + 6t$

Calculate the time taken by the baseball to reach the ground. **(2 marks)**



Motion of a baseball

SECTION 2

Non Linear Relations (13 marks)

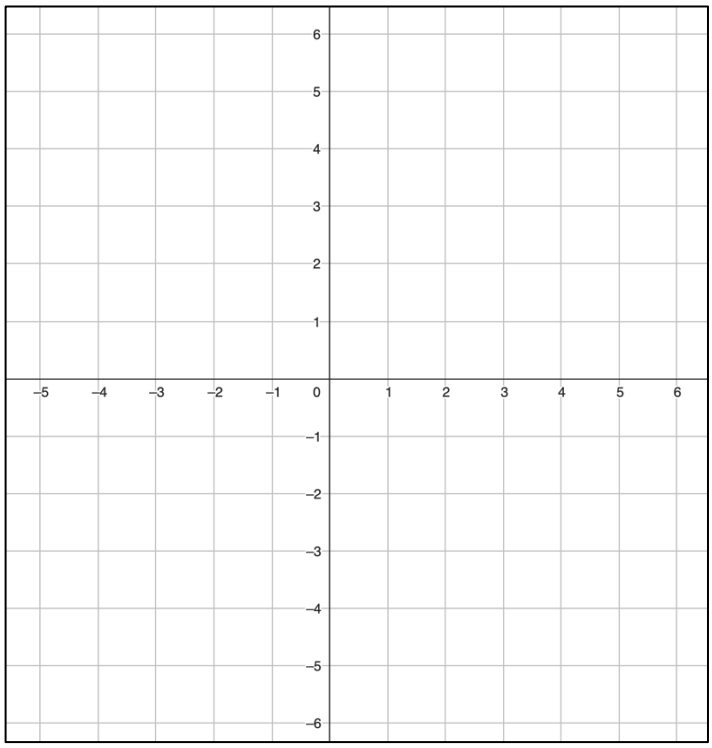
13. Consider the parabola $y = -1(x - 3)(x + 1)$

(a) What is the *y*-intercept? **(1 mark)**

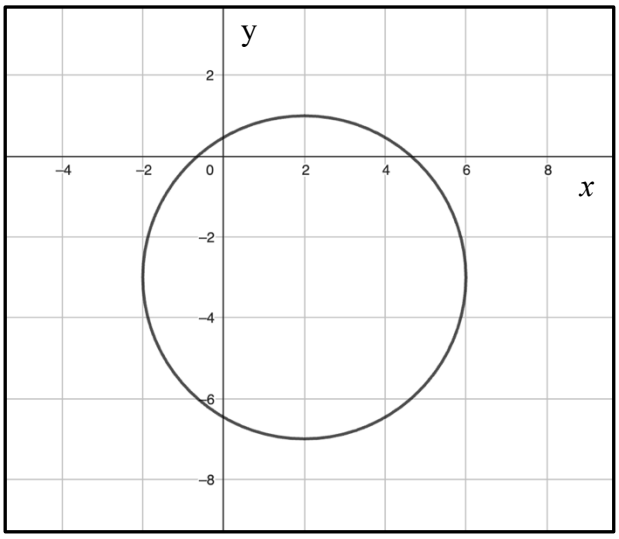
(b) Find the two *x*-intercepts. **(2 marks)**

(c) What are the co-ordinates of the vertex? **(2 marks)**

(d) Sketch the parabola on the set of axes provided. Ensure you clearly label the intercepts and vertex. **(2 marks)**



14. Write down the equation of the circle below. **(2 marks)**



15. Describe the transformations that would change the hyperbola $y = \frac{3}{x}$ into $y = \frac{-3}{x-5}$

(2 marks)

16. In the diagram alongside, what are the co-ordinates of P, a point on the x-axis? Show your working.

(2 marks)

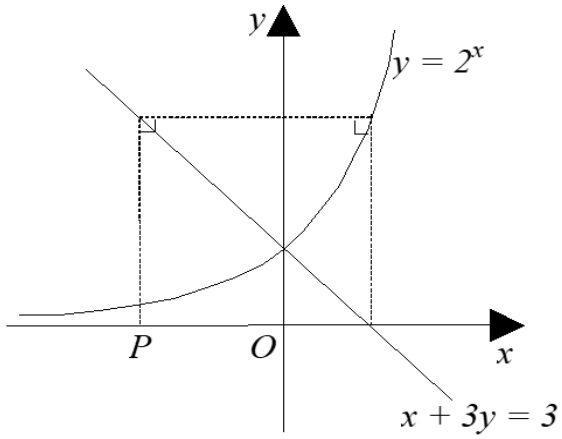
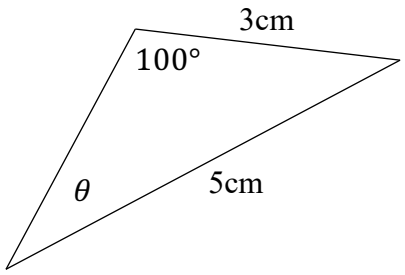


Diagram not to scale

Pythagoras and Trigonometry (14 marks)

17. In the diagram alongside

(a) Use the sine rule to calculate the unknown angle θ (correct to the nearest degree) **(2 marks)**

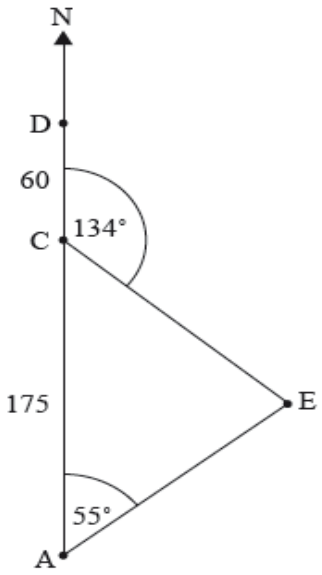


(b) Find the area of the triangle to the nearest cm^2

(2 marks)

18. A ship is sailing north from a point A towards point D. Point C is 175 km north of A. Point D is 60 km north of C. There is an island at E. The bearing of E from A is 055°. The bearing of E from C is 134°. This is shown in the following diagram.

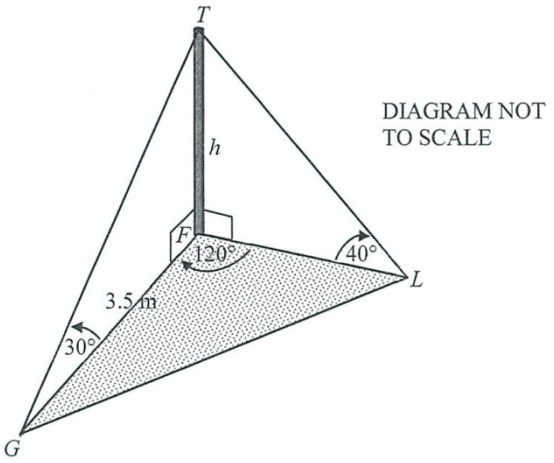
diagram not to scale



(a) Find the bearing of A from E. **(1 mark)**

(b) Use the Sine Rule to find CE to the nearest whole km. **(3 marks)**

19. A gate post, TF, is cemented vertically into a section of level ground, as shown in the diagram below.



From two points on the ground at G and L, the angles of elevation of the top of the post are 30° and 40° respectively. The distance from G to the foot of the post F, is 3.5 m and angle GFL at ground level is 120°.

(a) Calculate the height (to the nearest metre) that the gate post is out of the ground.

(2 marks)

(b) What is the distance (correct to the nearest m) that L is from F?(Use your rounded answer from (a))

(2 marks)

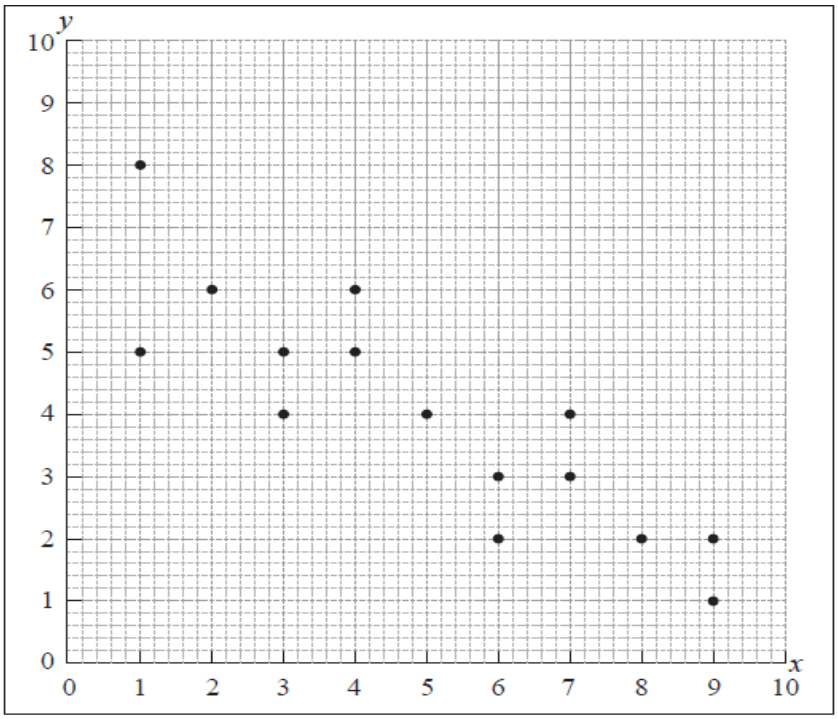
(c) Use the cosine rule to calculate the distance between points G and L on the ground.(correct to the nearest m) (Use your rounded answer from (b))

(3 marks)

Statistics (10 marks)

20. Consider the following values of x and y and the scatter diagram which represents the information given in the table.

x	1	1	2	3	3	4	4	a	6	6	7	7	8	9	9
y	5	8	6	4	5	5	6	4	2	3	3	4	2	1	2



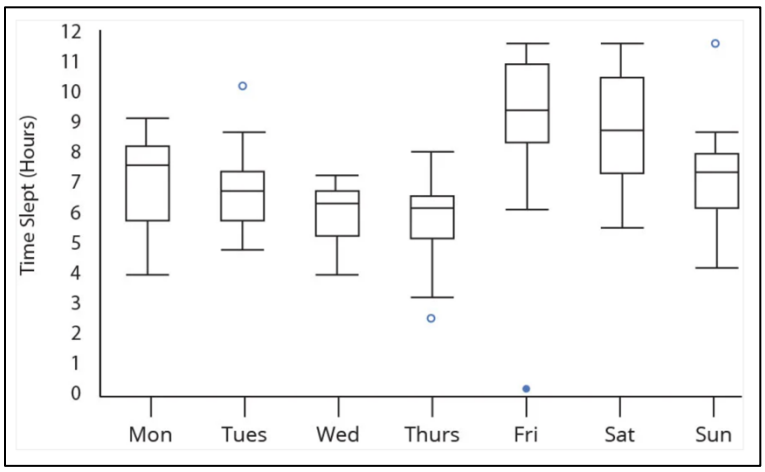
(a) The mean of the x values is 5 and the mean of the y values is 4. Write down the value of a in the table **(2 marks)**

(b) Draw the line of best fit on the scatter diagram above. **(1 mark)**

(c) Use your line of best fit to **estimate** the value of y when $x = 6.5$. **(1 mark)**

(d) Is this an extrapolation or interpolation? **(1 mark)**

21. Below are the box and whisker plots for a sleep study conducted over the course of a week. Use the plots to answer the following questions



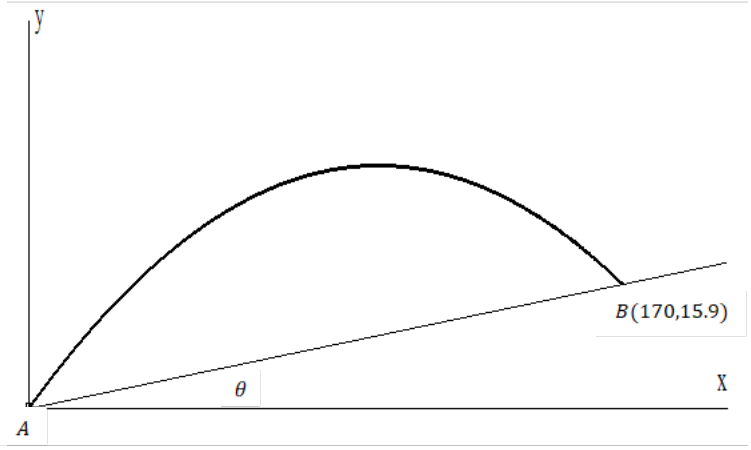
(a) What is the interquartile range for Monday? **(1 mark)**

(b) Which day has the smallest sleep range ? **(1 mark)**

(c) In a short paragraph, compare the data for Tuesday and Saturday and try to explain why there is a significant difference. In your paragraph, you should refer to the interquartile range, median and outliers. **(3 marks)**

Problem Solving (10 marks)

22. Mr Lendrum hits a golf ball up a slope (angle of θ to the horizontal) from point A to B. The golf ball followed a parabolic path as shown in the graph below. The path of the golf ball can be described by the equation:. $y = 0.003125x(200 - x)$
All distances are in metres and the coordinates of point B are shown.



(a) Find the horizontal distance the golf ball would have travelled if the ground had been flat.

(1 mark)

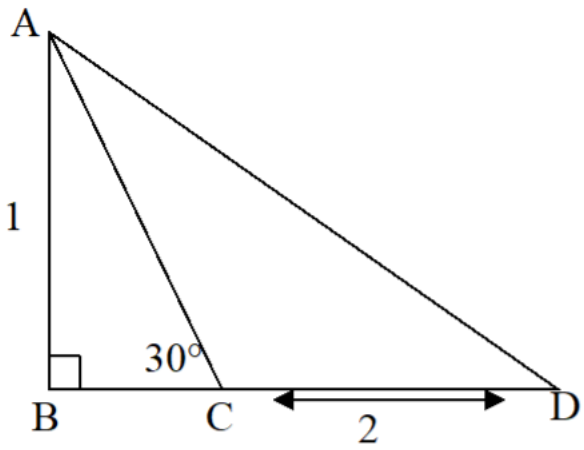
(b) Use point B to show that the size of angle θ to the nearest degree is 5°.

(2 marks)

(c) Find the maximum height reached by the ball above the ground to the nearest m.

(3 marks)

23. Consider the triangle below



a. Use trigonometry to show that the size of angle BAD is $75°$.

(2 marks)

b. Hence find the exact value of $\tan 75°$ in simplest exact surd form.

(2 marks)

END OF EXAM

EXTRA PAPER

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Year 10 Mathematics Reference Sheet

Measurement

Surface area

$A_{(\text{cylinder})} = 2\pi r^2 + 2\pi rh$

$A_{(\text{sphere})} = 4\pi r^2$

Volume

$V_{(pyramid/cone)} = \frac{1}{3}Ah$

$V_{(Sphere)} = \frac{4}{3}\pi r^3$

Functions

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Relations

$(x - h)^2 + (y - k)^2 = r^2$

Factorisation

$a^2 - b^2 = (a + b)(a - b)$

$a^2 + 2ab + b^2 = (a + b)^2$

Trigonometric functions

$sin\theta = \frac{opposite}{hypotenuse}$

$cos\theta = \frac{adjacent}{hypotenuse}$

$tan\theta = \frac{opposite}{adjacent}$

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

$c^2 = a^2 + b^2 - 2ab\cos C$

$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$

$A = \frac{1}{2}ab\sin C$

Linear functions

Distance between two points

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Point-gradient form of the equation of a line

$y - y_1 = m(x - x_1)$

Gradient-intercept form of the equation of a line

$y = mx + c$

Slope (gradient) of a line

$m = \frac{y_2 - y_1}{x_2 - x_1}$

Financial mathematics

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

Probability

$\Pr(A \cup B) = \Pr(A) + \Pr(B) - \Pr(A \cap B)$

$Pr(A|B) = \frac{Pr(A \cap B)}{Pr(B)}$

Statistics

An outlier is a score:

less than $\text{Q}_1 - 1.5 \times \text{IQR}$

or

more than $\text{Q}_3 + 1.5 \times \text{IQR}$

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Solutions

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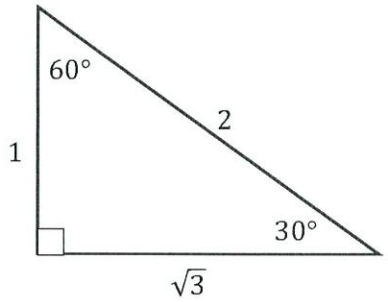
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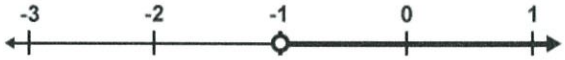
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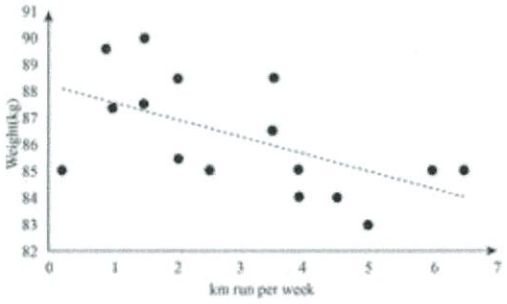
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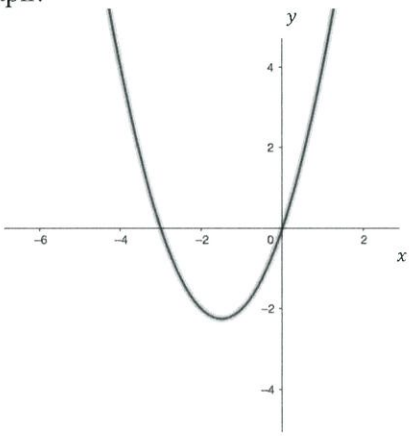
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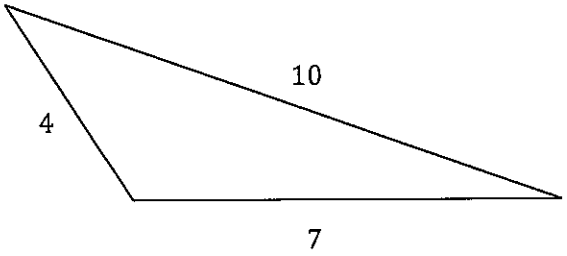
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SECTION 1

Linear Relations (11 marks)

1. Solve $3(2x + 5) = 4 - x$

   Show clear algebraic working. **(3 marks)**

$6x + 15 = 4 - x$ ✓

$(+x)\quad 7x + 15 = 4$ ✓

$(-15)\quad 7x = -11$

$(\div 7)\quad x = \frac{-11}{7}$ ✓

3

2. Simply: $\frac{7x}{3} - \frac{2x-1}{9}$ **(3 marks)**

$\frac{21x}{9} - \frac{(2x-1)}{9}$ ✓

$= \frac{21x - 2x + 1}{9}$ ✓

$= \frac{19x + 1}{9}$ ✓

3

3. Point $A(1, -22)$ and point $B(5, -2)$ together form a line AB.

(a) Show that the equation of line **AB** is $y = 5x - 27$ **(2 marks)**

$m_{AB} = \frac{-2-(-22)}{5-1}$

$= 5$ ✓

$y + 2 = 5(x-5)$ ✓ [Point Gradient]

$y = 5x - 25 - 2$

$= 5x - 27$

(2)

(b) Line **L** has an equation $3x + 2y = -2$. Use simultaneous equations to find the point of intersection between line **L** and line **AB.** **(3 marks)**

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

$y = 5x - 27$ (2)

sub (2) into (1)

$3x + 2(5x-27) = -2$

$3x + 10x - 54 = -2$

$13x - 54 = -2$

$13x = 52$

$x = 4$ ✓

sub $x = 4$ into (2)

$y = 5(4) - 27$

$= -7$ ✓

Point of intersection $(4, -7)$

attempt at sub or elimination ✓

(3)

Probability (7 marks)

4. Each letter in the word EQUILATERAL is written on a separate card. These cards are then placed face down on a table.

   What is the probability that a card containing a letter A or E is randomly turned over?

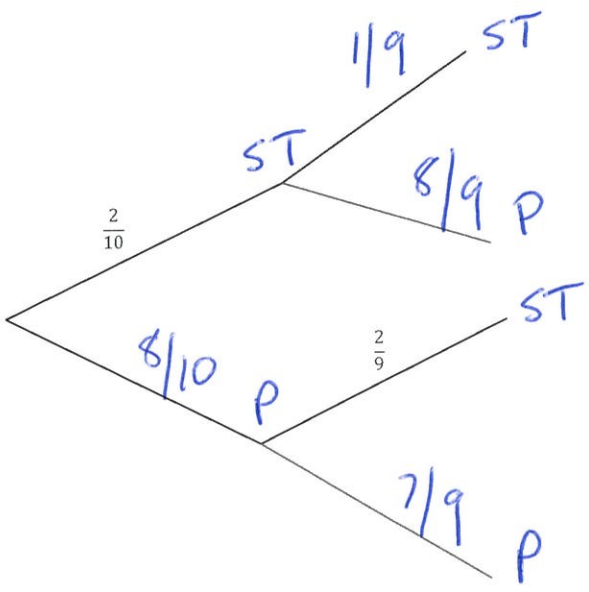
   (1 mark)

$\frac{4}{11}$ ✓

(1)

5. Raphael does not like strawberry flavoured chocolates. In a dark cinema during a film, Raphael selects two chocolates at random without replacement from a box. There are 10 chocolates in the box. Of these chocolates, 2 are strawberry flavoured and 8 are plain chocolate.

   (a) Represent this information by completing the tree diagram below **(2 marks)**



✓✓m

1 off for each mistake

(2)

   (b) What is the probability that Raphael selects **at least** 1 strawberry flavoured chocolate? **(2 marks)**

P(at least 1 ST) = 1 − P(PP) ✓

= 1 − 8/10 × 7/9

= 17/45 ✓

(2)

OR P(ST, ST) + P(ST, P) + P(P, ST)

$= \frac{2}{10} \times \frac{1}{9} + \frac{2}{10} \times \frac{8}{9} + \frac{8}{10} \times \frac{2}{9}$

= 17/45

6. The Venn diagram shows students that are studying a language subject (French, Spanish and German).

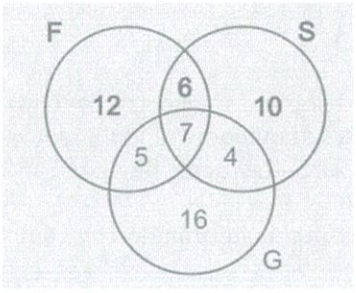
(a) What is the probability of a student studying all three subjects? **(1 mark)**

7/60 ✓ (1)

(b) What is the probability of a student studying all three subjects, given that they are studying at least two subjects? **(1 mark)**

$\frac{7}{5+7+6+4}$

$= \frac{7}{22}$ ✓ (1)



Indices and Surds (7 marks)

7. Use the index laws to fully simplify

$\frac{(-5x^0y^6)^2}{y^4}$ **(2 marks)**

$= \frac{25y^{12}}{y^4}$ ✓

$= 25y^8$ ✓ (2)

8. Simplify by first rationalising the denominator **(2 marks)**

$\frac{1+\sqrt{3}}{2\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$ ✓

$= \frac{\sqrt{3}+3}{6}$ ✓ (2)

9. Rachael invests $8000 in a savings account for 4 years. The savings account pays compound interest at a rate of:

   4.5% p.a. for the first year

   2.75% p.a. for the next three years

(a) How much will Rachael's investment be worth at the end of the first year? **(1 mark)**

$A = 8000 \times \left(1 + \frac{4.5}{100}\right)^1$

$= \$8360$ ✓ (1)

(b) How much will Rachael's investment be worth at the end of 4 years if interest is compounded yearly?(answer correct to the nearest cent) **(2 marks)**

$A = 8360 \times \left(1 + \frac{2.75}{100}\right)^3$ ✓

$\approx 9068.840\ldots$

$\approx \$9068.84$ ✓ (2)

[Needs to be correct to nearest cent for 2nd mark]

Factors and Products (9 marks)

10. Fully factorise the following:

(a) $y^2 - 100x^2$ **(2 marks)**

$y^2 - (10x)^2$ Recognition of DOPS ✓

$= (y - 10x)(y + 10x)$ ✓ (2)

(b) $6m^2 + m - 2$ **(2 marks)**

$6m^2 + 4m - 3m - 2$

$= 2m(3m + 2) - 1(3m + 2)$

$= (2m - 1)(3m + 2)$ (2)

✓ ✓

11. Simplify $\frac{p^2+2p-15}{p^2-3p}$ by first factorising the numerator and denominator

(3 marks)

$$\frac{(p+5)(p-3)}{p(p-3)} \checkmark \checkmark$$

$$= \frac{p+5}{p} \checkmark$$

3

12. Consider a person throwing a baseball from ground level. The baseball will reach its peak height and fall back to the ground. At time t (in seconds), the height h (in metres) from the ground is given by $h = -t^2 + 6t$

Calculate the time taken by the baseball to reach the ground. **(2 marks)**

$h = -t(t-6)$ ✓

$h = 0$ when $t = 6$

$\Rightarrow$ 6 seconds ✓



Motion of a baseball

2

SECTION 2

Non Linear Relations (13 marks)

13. Consider the parabola $y = -1(x - 3)(x + 1)$

(a) What is the y-intercept? **(1 mark)**

$x = 0$

$y = 3$ ✓ (1)

(b) Find the two x-intercepts. **(2 marks)**

$0 = -1(x-3)(x+1)$

$x = 3$ or -1 ✓ ✓ (2)

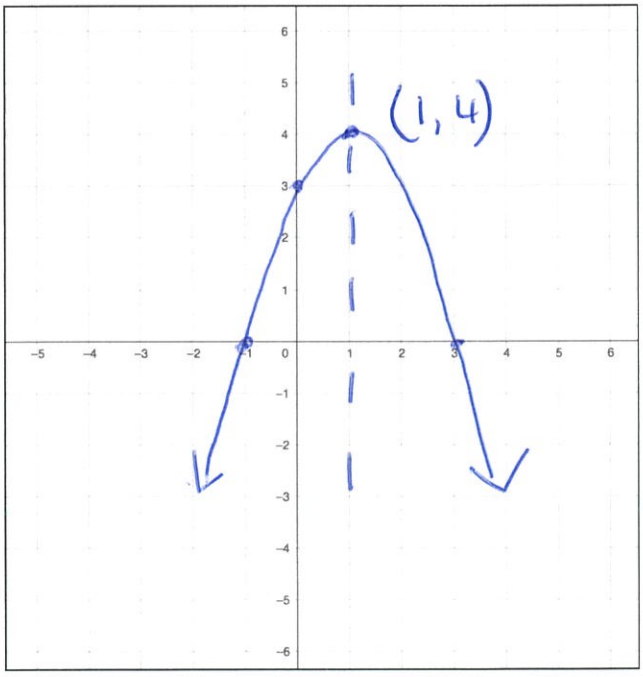
(c) What are the co-ordinates of the vertex? **(2 marks)**

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

$= 1$ ✓ $= 4$ ✓ (2)

so vertex $(1, 4)$.

(d) Sketch the parabola on the set of axes provided. Ensure you clearly label the intercepts and vertex. **(2 marks)**



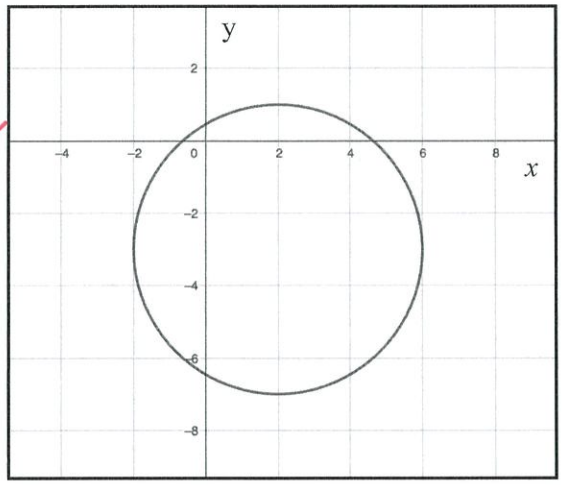
shape ✓

correct key points ✓

(2)

14. Write down the equation of the circle below. **(2 marks)**

$(x-2)^2+(y+3)^2=16$ ✓ ✓



(2)

15. Describe the transformations that would change the hyperbola $y=\frac{3}{x}$ into $y=\frac{-3}{x-5}$

(2 marks)

$y=\frac{3}{x} \rightarrow \frac{-3}{x} \rightarrow \frac{-3}{x-5}$

⇒ reflection (flip) across x-axis ✓ (2)

followed by translation 5 units ✓ to right

16. In the diagram alongside, what are the co-ordinates of P, a point on the x-axis? Show your working.

(2 marks)

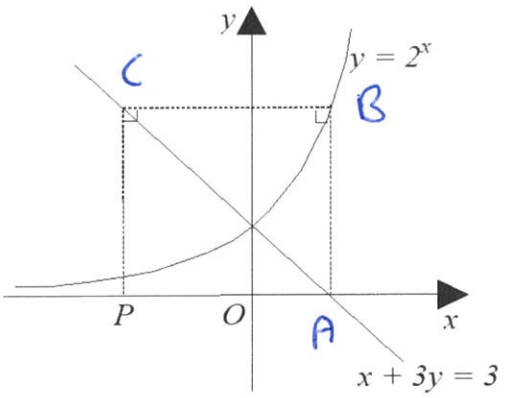


Diagram not to scale

A: when $y = 0$, $x = 3$

B: when $x = 3$, $y = 8$

C: when $y = 8$, $x = -21$

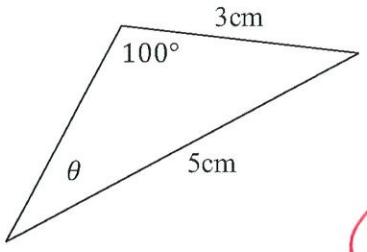
} Some progression towards P ✓

So $P(-21, 0)$ ✓

Pythagoras and Trigonometry (14 marks)

17. In the diagram alongside

(a) Use the sine rule to calculate the unknown angle θ (correct to the nearest degree) **(2 marks)**



$\frac{\sin\theta}{3} = \frac{\sin 100}{5}$ ✓

$\sin\theta = \frac{3\sin 100}{5}$

$= 0.59088$

$\theta = 36°$ (nearest degree) ✓

(2)

[no marks off for incorrect rounding ie ignore rounding errors.]

(b) Find the area of the triangle to the nearest cm^2 **(2 marks)**

$A = \frac{1}{2}ab\sin C$ ✓

$= \frac{1}{2} \times 3 \times 5 \times \sin 44$

$= 5.209\ldots$

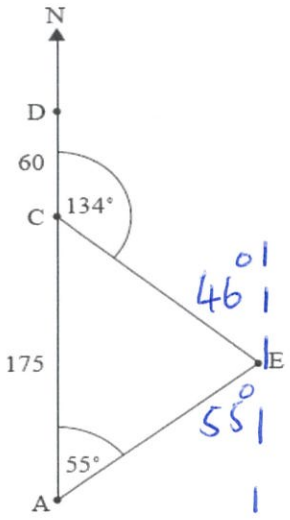
$\approx 5\,cm^2$ ✓

(2)

[no marks off for incorrect rounding ie ignore rounding errors]

18. A ship is sailing north from a point A towards point D. Point C is 175 km north of A. Point D is 60 km north of C. There is an island at E. The bearing of E from A is 055°. The bearing of E from C is 134°. This is shown in the following diagram.

diagram not to scale



(a) Find the bearing of A from E. **(1 mark)**

$360° - 46°$

$180° + 55° = 235°$ ✓ (1)

(b) Use the Sine Rule to find CE to the nearest whole km. **(3 marks)**

$\angle CEA = 180° - 55° - 46°$

$= 79°$ ✓

(3)

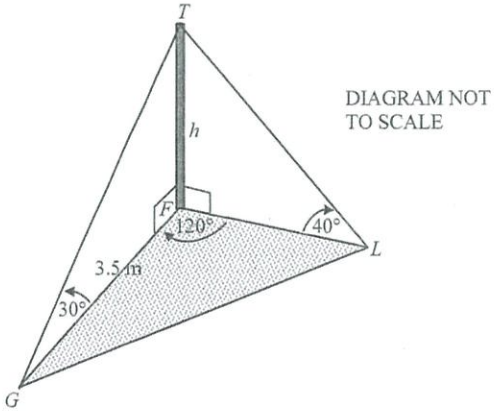
$$\frac{CE}{\sin 55°} = \frac{175}{\sin 79°}$$ ✓

$$CE = \frac{175 \times \sin 55°}{\sin 79°}$$

$= 146$ km (nearest km) ✓

[ignore rounding error]

19. A gate post, TF, is cemented vertically into a section of level ground, as shown in the diagram below.



From two points on the ground at G and L, the angles of elevation of the top of the post are 30° and 40° respectively. The distance from G to the foot of the post F, is 3.5 m and angle GFL at ground level is 120°.

(a) Calculate the height (to the nearest metre) that the gate post is out of the ground.

(2 marks)

In $\triangle TGF$ ✓

$\frac{h}{3.5} = \tan 30^\circ$

$\Rightarrow h = 3.5 \times \tan 30^\circ$

$\approx 2m$ ✓

(2)

(b) What is the distance (correct to the nearest m) that L is from F?(Use your rounded answer from (a))

(2 marks)

$\frac{h}{LF} = \tan 40^\circ$ ✓

$LF = \frac{\tan 40^\circ}{h}$

$\approx 2m \ (2.38\ldots)$ ✓

(2)

(c) Use the cosine rule to calculate the distance between points G and L on the ground.(correct to the nearest m) (Use your rounded answer from (b))

(3 marks)

$GL^2 = 3.5^2 + 1.7^2 - 2 \times 3.5 \times 1.7 \times \cos 120^\circ$

≈ 21.09

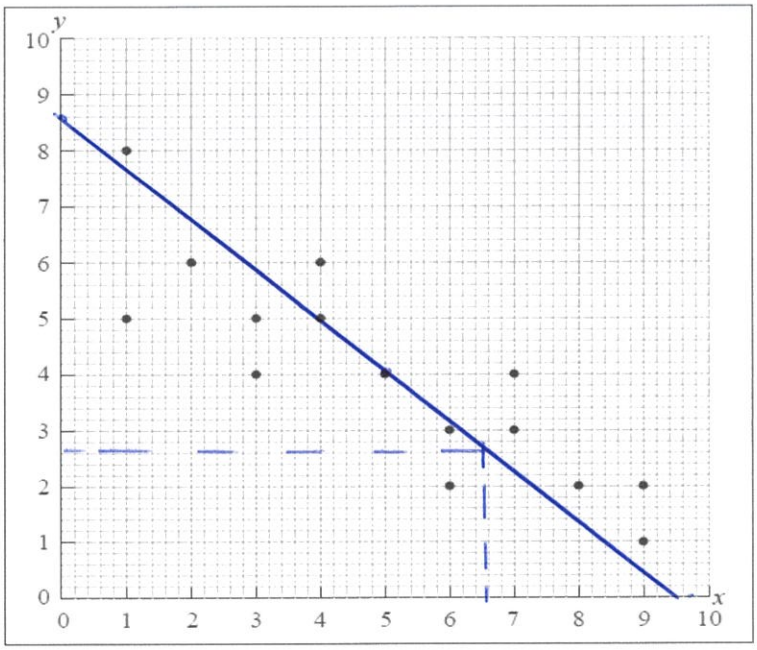
$GL \approx 5m$

Use of cos rule ✓
correct substitution ✓
answer ✓

Statistics (10 marks)

20. Consider the following values of x and y and the scatter diagram which represents the information given in the table.

x	1	1	2	3	3	4	4	a	6	6	7	7	8	9	9
y	5	8	6	4	5	5	6	4	2	3	3	4	2	1	2



(a) The mean of the x values is 5 and the mean of the y values is 4. Write down the value of a in the table **(2 marks)**

$$\frac{1+1+2+3 \cdots 9+9}{15} = 5$$

$$\frac{70+a}{15} = 5 \Rightarrow a = 5$$ (2)

(b) Draw the line of best fit on the scatter diagram above. **(1 mark)**

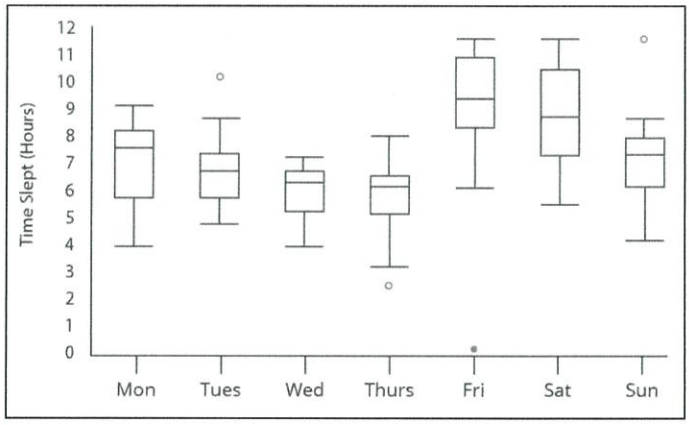
(c) Use your line of best fit to **estimate** the value of y when $x = 6.5$. **(1 mark)**

$y \approx 2.75$ (1)

(d) Is this an extrapolation or interpolation? **(1 mark)**

Interpolation (1)

21. Below are the box and whisker plots for a sleep study conducted over the course of a week. Use the plots to answer the following questions



(a) What is the interquartile range for Monday? **(1 mark)**

8 − 6 = 2 ✓(1)

(b) Which day has the smallest sleep range ? **(1 mark)**

Wednesday. ✓(1)

(c) In a short paragraph, compare the data for Tuesday and Saturday and try to explain why there is a significant difference. In your paragraph, you should refer to the interquartile range, median and outliers. **(3 marks)**

On Tuesday: smaller IQR, smaller median and 1 outlier ✓

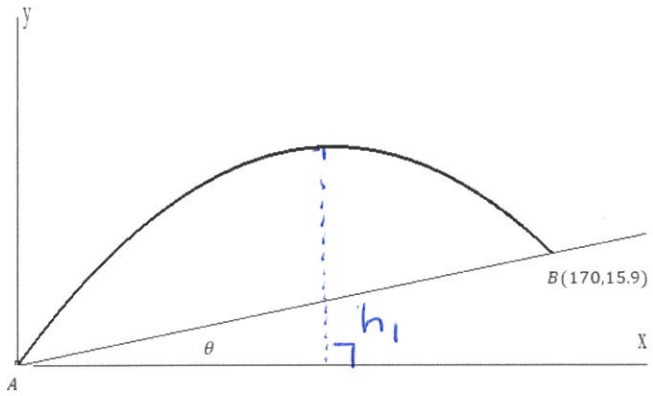
On Saturday: larger IQR and larger median } 1 mark

Possible reasons: People work less on Saturdays and sleep in. ✓ Greater variability in how people spend their time on a weekend ⇒ greater IQR.

{two good reasons}

Problem Solving (10 marks)

22. Mr Lendrum hits a golf ball up a slope (angle of θ to the horizontal) from point A to B. The golf ball followed a parabolic path as shown in the graph below. The path of the golf ball can be described by the equation:. $y = 0.003125x(200 - x)$
All distances are in metres and the coordinates of point B are shown.



(a) Find the horizontal distance the golf ball would have travelled if the ground had been flat.

(1 mark)

200m ✓ (1)

(b) Use point B to show that the size of angle θ to the nearest degree is 5°.

(2 marks)

$\tan\theta = \frac{15.9}{170}$ ✓

$\Rightarrow \theta = \tan^{-1}\left(\frac{15.9}{170}\right)$ ✓ (2)

$\approx 5^\circ$

(c) Find the maximum height reached by the ball above the ground to the nearest m.

(3 marks)

when $x = 100$, $y = 31.25$ (vertex) ✓

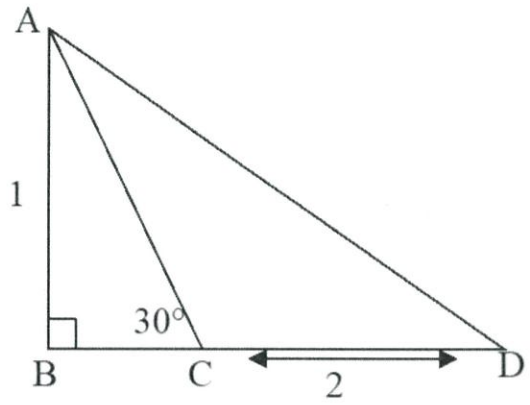
$h_1 = \tan 5^\circ \times 100$

$= 8.7488\ldots$ m ✓

Max height above ground $= 31.25 - 8.7488$

≈ 23m ✓ (3)

23. Consider the triangle below



a. Use trigonometry to show that the size of angle BAD is 75°.

(2 marks)

In $\triangle ABC$, $BC = \frac{1}{\tan 30^\circ}$

$= 1.732$ ✓

In $\triangle ABD$, $B\hat{A}D = \tan^{-1}\left(\frac{BD}{AB}\right)$ ✓

$= \tan^{-1}\left(\frac{2.732}{1}\right)$ (2)

$= 75^\circ$

b. Hence find the exact value of tan 75° in simplest exact surd form.

(2 marks)

$AC = \frac{1}{\sin 30^\circ}$

$= 2$

$BC = \sqrt{2^2 - 1^2}$

$= \sqrt{3}$ ✓

$\tan 75^\circ = \frac{BD}{AB}$ (2)

$= \frac{\sqrt{3}+2}{1}$

$= \sqrt{3}+2$ ✓

END OF EXAM