Student Number:
Teacher:

St George Girls High School

Mathematics Standard 2

2020 Trial HSC Examination

General Instructions

- Reading time – 10 minutes
- Working Time – 2 hours and 30 minutes
- Write using black pen
- Calculators approved by NESA may be used
- A reference sheet is provided at the back of this paper
- For questions in Section I, use the multiple-choice answer sheet provided.
- For questions in Section II:
    - Answer the questions in the space provided
    - Show relevant mathematical reasoning and/or calculations
    - Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering
    - Marks may not be awarded for incomplete or poorly presented solutions

Total marks: 100

Section I – 15 marks (pages 3 – 9)

- Attempt Questions 1 - 15
- Allow about 25 minutes for this section

Section II – 85 marks

- Attempt Questions 16 – 43
- Allow about 2 hour and 5 minutes for this section

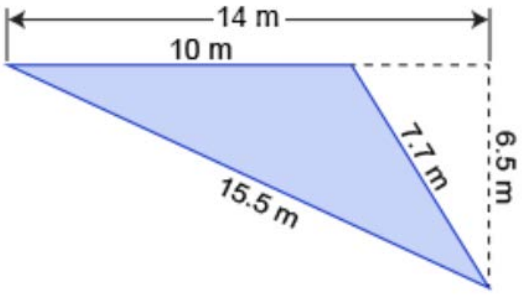
Section I

15 marks
Attempt questions 1 - 15
Allow about 25 minutes for this section
Use the multiple-choice answer sheet for questions 1-15

1. Hayley invests $4000 at 3% pa compounding monthly. What is the value of her investment (to the nearest dollar) after 5 years?

(A) $4 600.00
(B) $4637.10
(C) $4646.47
(D) $17599.16

2. What is the area of this triangle in square metres?

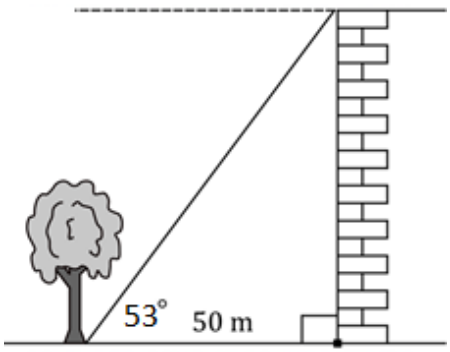


(A) 32.5
(B) 38.5
(C) 45.5
(D) 50.375

3. Jim, a landscaping contractor, charges by the hour for his company's services. To complete a particular job, he will have to use three workers and pay each of them $20 per hour. The fixed costs for the job are $150 and it will take four hours to complete the job. To break even on this job, his hourly charge to the client should be:

(A) $97.50
(B) $107.50
(C) $127.50
(D) $132.50

4. The angle of elevation from the base of the tree to the top of the building is 53°. The base of the building is 50 metres from the base of the tree.



What is the height of the building, correct to the nearest metre?

(A) 30

(B) 40

(C) 66

(D) 67

5. The capacity of the fuel tank of Jane's car is 65 litres. She starts driving with a full tank and the car consumes 0.15 litres per km.
Which of the following linear equations describes the volume (V) in litres of fuel in the tank, after travelling k km?

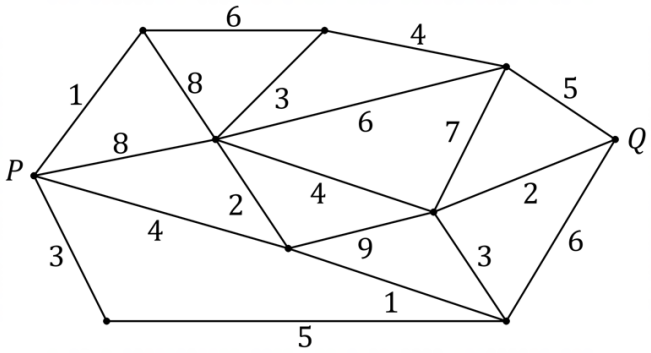
(A) $V = -0.15k - 65$

(B) $V = -0.15k + 65$

(C) $V = 0.15k + 65$

(D) $V = 0.15k - 65$

6. The following network shows the time, in hours, that it takes to travel along a series of roads that connect town P to town Q.



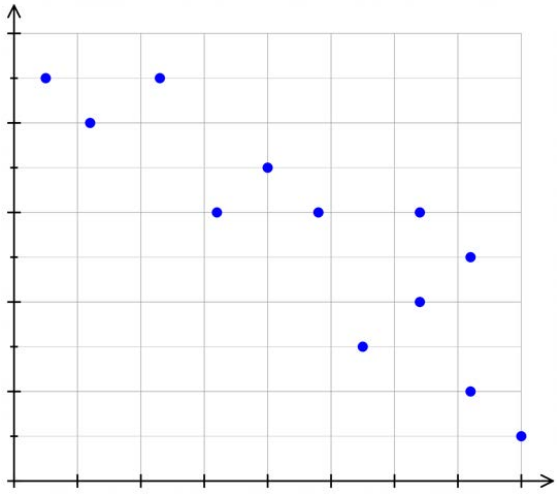
What is the shortest time, in hours, that it would take to travel from town P to town Q?

(A) 8

(B) 9

(C) 10

(D) 14

7. 

The correlation coefficient of the above scatter plot is closest to:

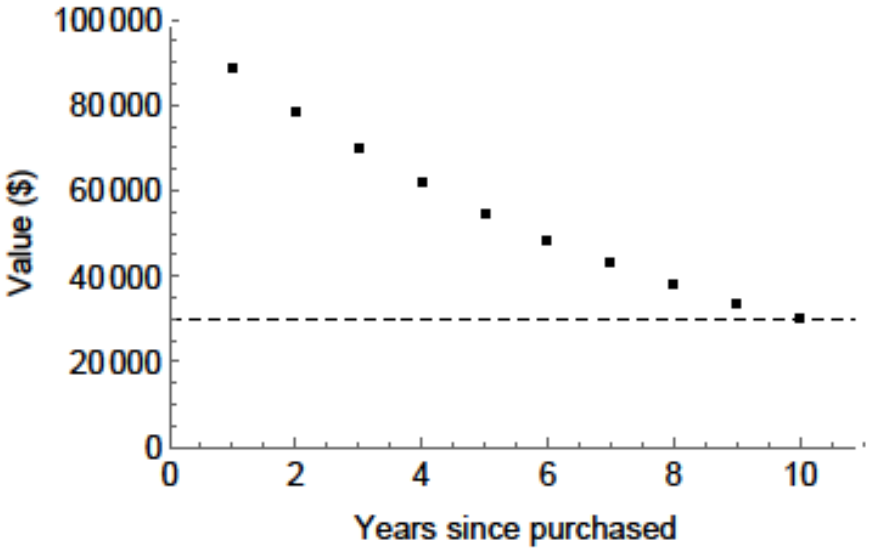
(A) 0.5

(B) -0.5

(C) 0.9

(D) -0.9

8. A large piece of machinery costs $100 000 and is depreciated using the declining-balance method. The graph below shows the value of the machinery at the end of each year for ten years.



Which of the following statements is true?

(A) The rate of depreciation increases every year.

(B) Each year, the machinery depreciates by $7000.

(C) The declining-balance depreciation rate is less than 10% per annum.

(D) The annual dollar value of the depreciation decreases over time.

9. Elizabeth lives in Sydney, NSW (UTC +10) and Margaret lives in Los Angeles, USA (UTC –8).

Margaret makes a call to Elizabeth at 12:30 pm on Monday 24th June.

What is the date and time in Sydney when Elizabeth receives the call?

(A) 6:30 pm Tuesday 25th

(B) 6:30 am Tuesday 25th

(C) 5:30 am Sunday 23rd

(D) 5:30 pm Monday 24th

10. The scale on an aerial photograph is given as 1 mm = 500 m. If the straight real distance between two towns is 1.2km, how far apart are these two towns on the map?

    (A) 2.4 mm
    (B) 24 mm
    (C) 4.2 mm
    (D) 0.42 mm

11. Nick bought a portfolio of 500 OptusNet shares with his retrenchment payout.

    The value of each share is currently $52.50, and Nick is paid an annual dividend of $2.75 per share.

    What is the dividend yield on the shares?

    (A) $1375
    (B) $26250
    (C) $5.2%
    (D) $10.5%

12. The length of a beach is measured as 1.45 km.

    What is the absolute error of this measurement?

    (A) 100 m
    (B) 50 m
    (C) 10 m
    (D) 5 m

13. Mitchell is going to buy a car and downloads data on fuel efficiency for three models.

Model	*Fuel Consumption (City)*	*Fuel Consumption (Country)*
Tacoma	15.8 L/100km	11.5 L/100km
Firenze	14.4 L/100km	11.4 L/100km
Vortex	15.6 L/100km	11.0 L/100km

In a test drive, he drives all three cars for 40 km on city roads and 120 km on country roads.

Based on the data, which car would use the least fuel on the test drive?

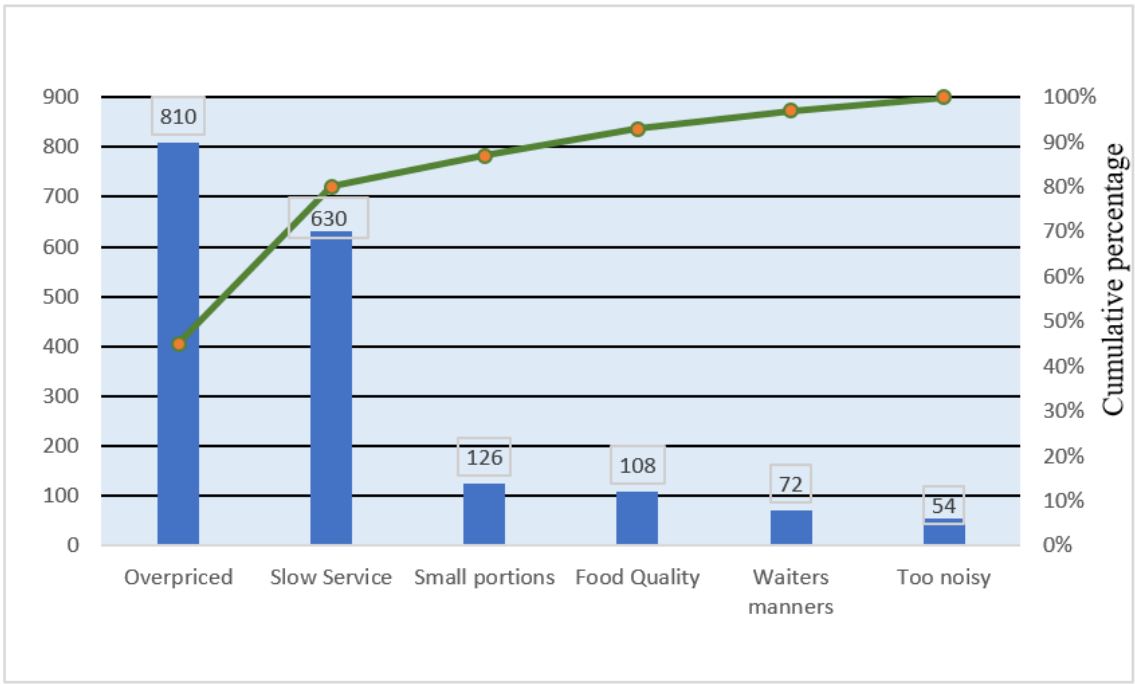
(A) The Firenze would use the least fuel

(B) The Firenze and the Tacoma are equal in using the least amount of fuel

(C) The Firenze and the Vortex are equal in using the least amount of fuel

(D) The Tacoma would use the least fuel

14. A restaurant owner collected data related to the reasons given by customers for being unhappy with his restaurant. The Pareto chart shows the data collected.



Which percentage of customers were unhappy because of the small portions?

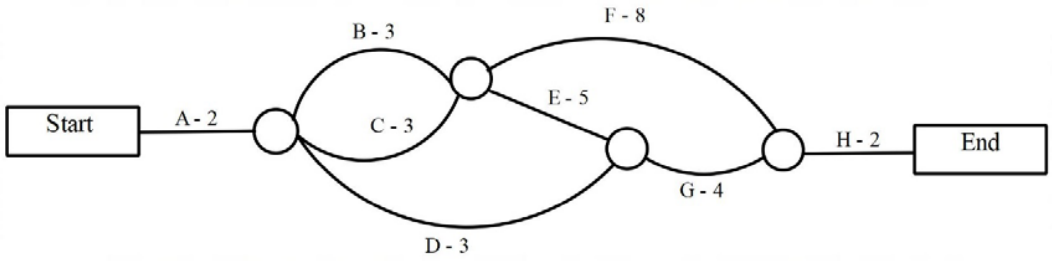
(A) 6% (B) 7% (C) 8% (D) 87%

15. The activity chart below shows the immediate prerequisite(s) and duration for each activity in a project.

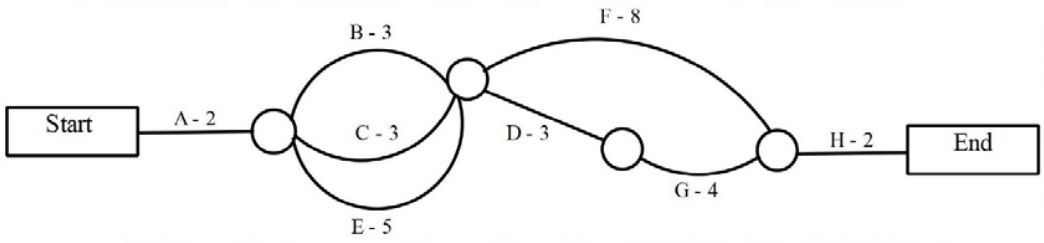
Activity	Immediate Prerequisites	Time (days)
A	-	2
B	A	3
C	A	3
D	B, C	3
E	A	5
F	B, C	8
G	D, E	4
H	F, G	2

Which network could be drawn from the activity chart?

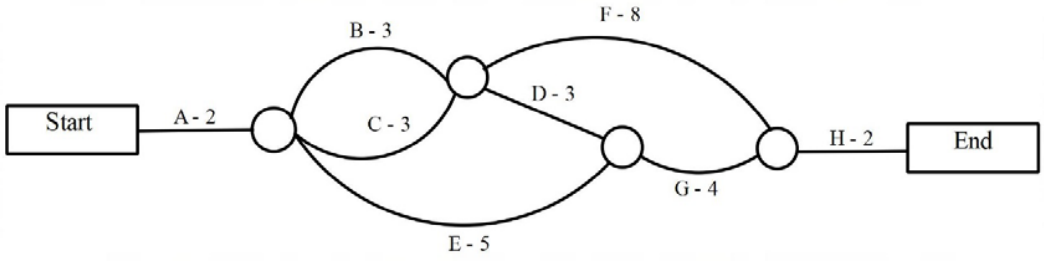
(A)



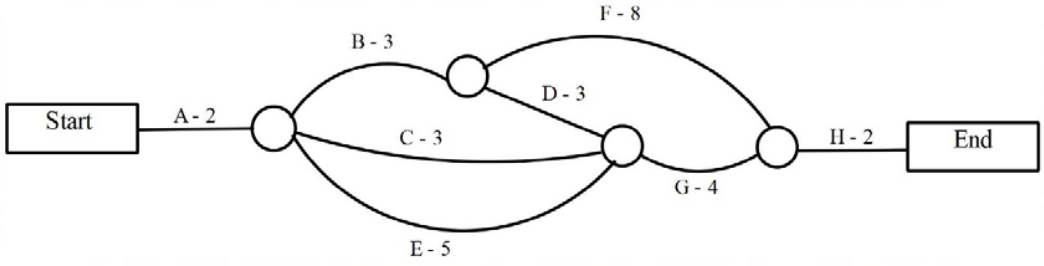
(B)



(C)



(D)



End of Section I

Section II

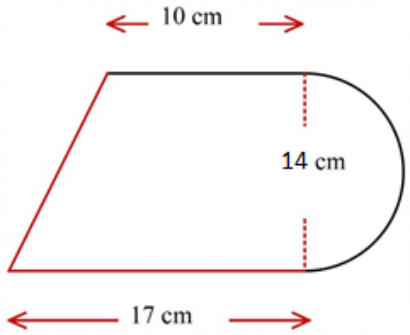
85 marks
Attempt all questions
Allow about 2 hours and 5 minutes for this section

Answer the questions in the spaces provided.

Your responses should include relevant mathematical reasoning and/or calculations.
Extra writing space is provided at the back of the examination paper.

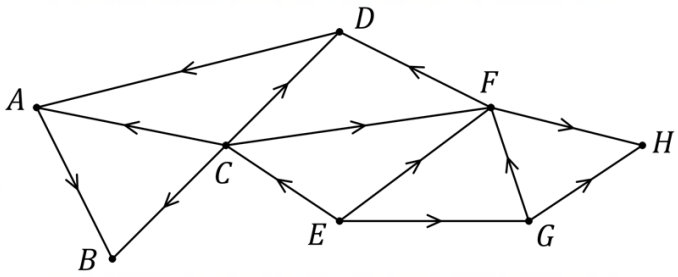
Question 16 (2 mark) **Marks**

Calculate the perimeter of the shape below, rounded to 3 significant figures. 2



Question 17 (2 marks) **Marks**

A maze contains eight statues. The statues are labelled *A* to *H* on the following directed graph. Walkers within the maze are only allowed to move in the directions of the arrows.



(a) Find two statues that a walker could not reach from statue *G*. 1

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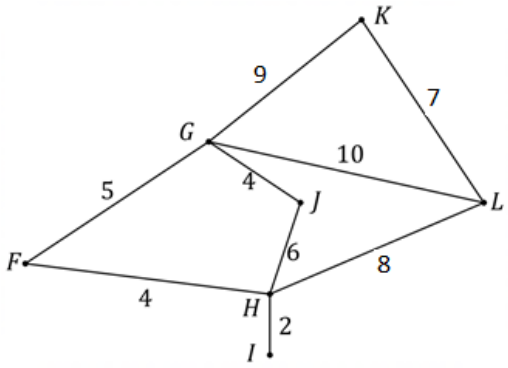
(b) One way that statue *D* can be reached from statue *E* is along path *ECD.* List two other ways that statue *D* can be reached from statue *E*. 1

.....

Question 18 (3 marks)

The network diagram shows seven campsites, *F*, *G*, *H*, *I*, *J*, *K* and *L*, which are joined by tracks. The numbers by the paths show lengths (in km) of that section of track.



(a) Find and highlight the minimum spanning tree of the network. 2

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(b) A telephone cable is to be laid along as few of the existing tracks as possible. What is the minimum length of cable necessary to complete this task? 1

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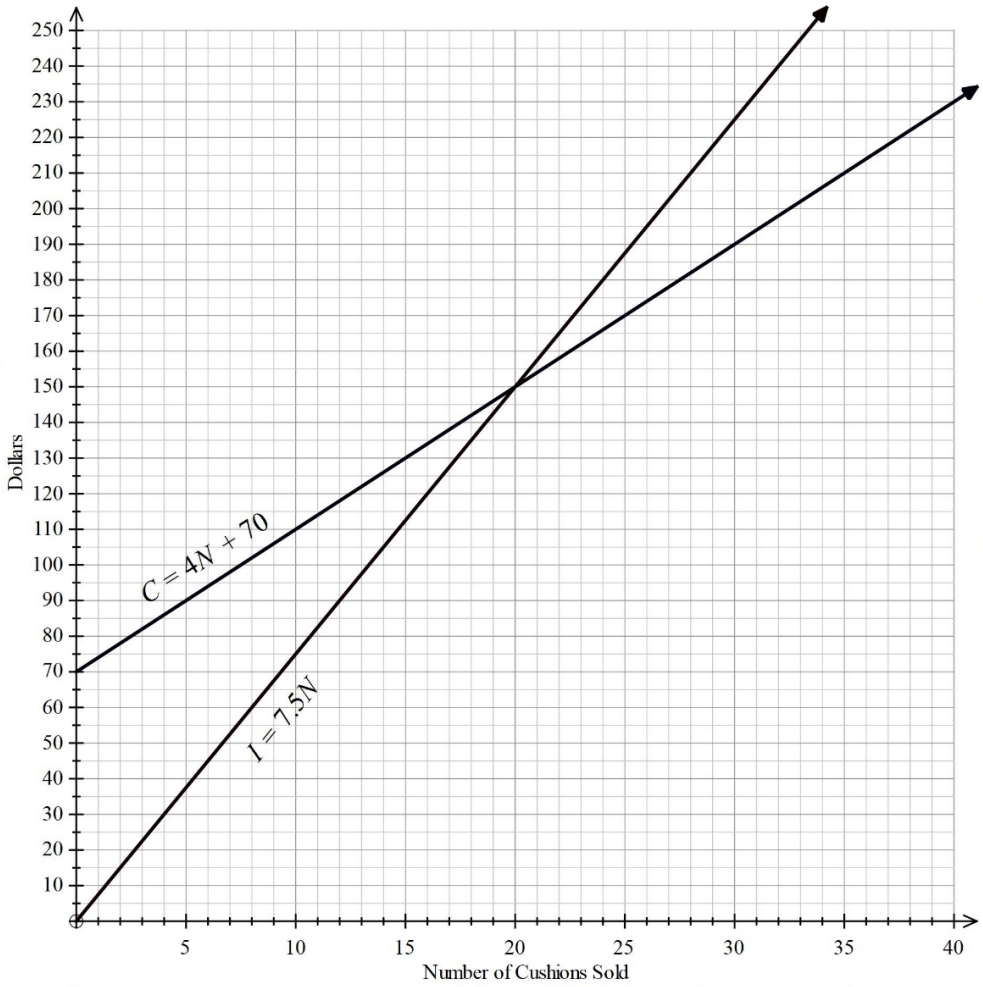
Question 19 (2 marks) **Marks**

An online retailer of cushions draws the graph below to analyse sales. The lines representing the equations for daily cost (C) and daily income (I) are shown.

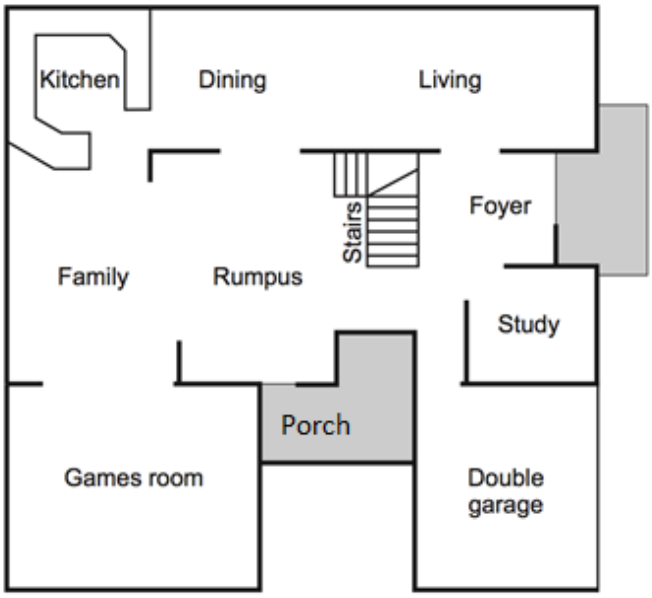


(a) Give an appropriate explanation for what the coefficient of N i.e. 4, could mean in the equation $C = 4N + 70$ 1

(b) What is the result on a day where 30 cushions were sold? 1

Question 20 (4 marks) **Marks**

The house plan of the ground floor is drawn below.

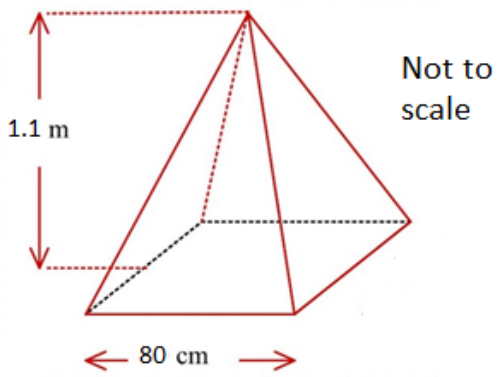


(a) The north side of the house which has Dining and Living is 12m long. What is the scale of the house plan? 1

(b) What is the cost of tiling the area that is labelled as porch on the south side, if tiling costs $150 per square metre? 3

Question 21 (2 marks) **Marks**

A pyramid has a vertical height of 1.1 m, and it has a square base of 80 cm.



Calculate the capacity of the pyramid in litres. 2

Question 22 (2 marks)

The formula below gives the blood alcohol concentration for a male.

$$BAC_{\text{Male}} = \frac{10N - 7.5H}{6.8M}$$

where N is the number of standard drinks consumed, H is the number of hours of drinking, and M is the person's weight in kilograms.

Charles weighs 70 kg and consumes 4 standard drinks in 2 hours.

What is his BAC, correct to 2 significant figure? 2

Marks

Question 23 (2 marks)

What is the least amount (to the nearest dollar) that must be invested now at 4.8% per annum, compounded monthly, so that in three years it will have grown to $25 000? 2

Question 24 (2 marks)

Angel sets up this spreadsheet to track the progress of her loan on a monthly basis.

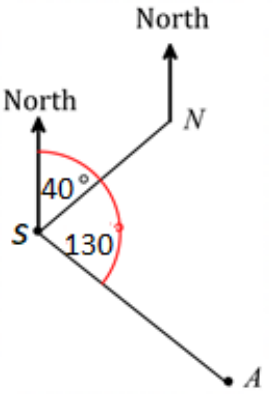
Principal (P) = $45 000.00				
Annual Interest rate (r) = 8%			This table assumes each month is one twelfth of a year.	
Monthly repayment (R) = $500.00				
N	Principal (P)	Interest (I)	*P + I*	*P + I - R*
1	$45,000.00	$300.00	$45,300.00	$44,800.00
2	$44,800.00	$298.67	$45,098.67	$44,598.67
3	$44,598.67	$297.32	$44,895.99	$44,395.99
4	$44,395.99	$295.97	$44,691.96	$44,191.96
5	$44,191.96			**Y**

Calculate the value that would appear at **Y**.

2

Question 25 (3 marks) **Marks**

Anthony and Natalie walk in different directions from the same camp site (***S***). Anthony walks for 12 km on a bearing of 130° to a lookout (***N***) and Natalie walks for 9 km on a bearing of 040° to a picnic ground (***A***). Anthony then walks directly from the lookout to meet Natalie at the picnic ground.

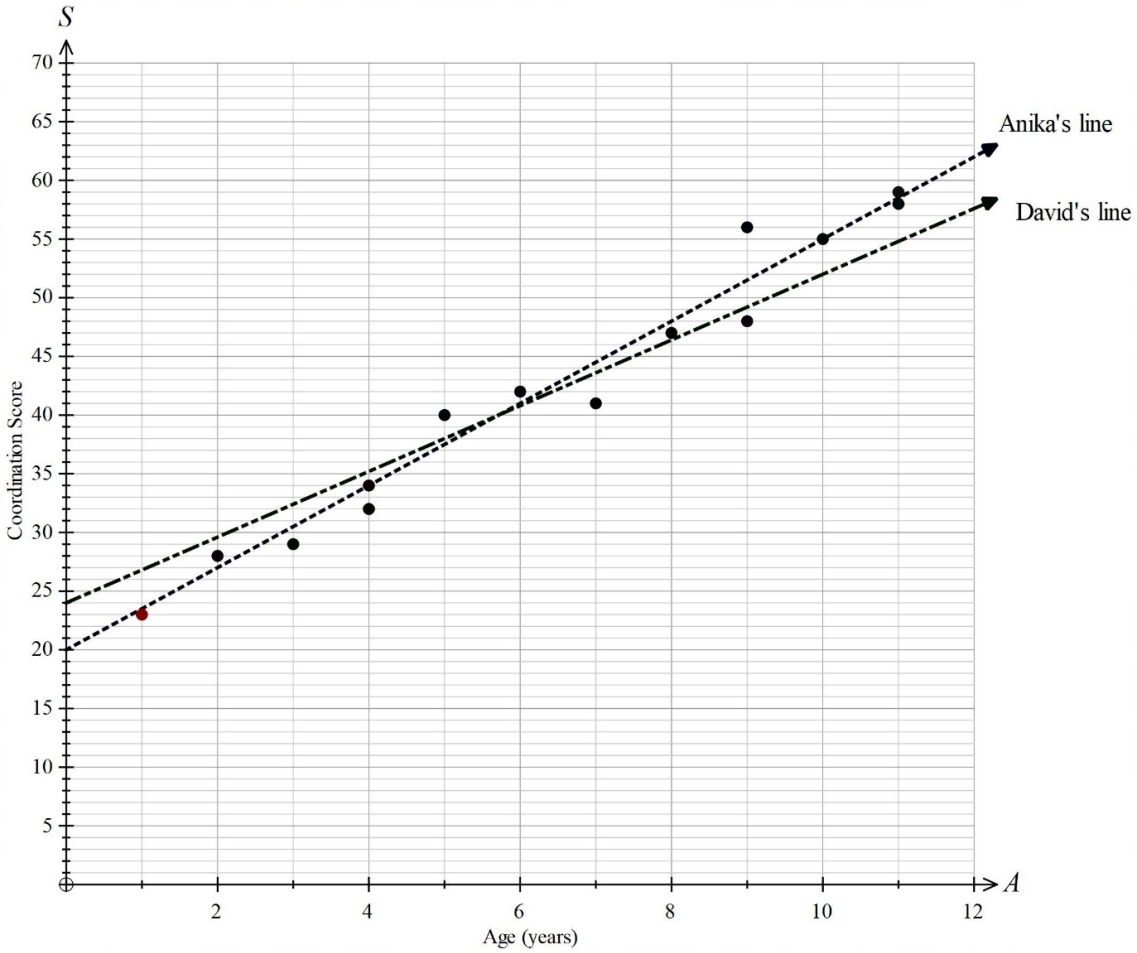


(a) What distance would Anthony have to walk to meet Natalie on the lookout point? 1

(b) On what bearing must Anthony walk? 2

Question 26 (3 marks) **Marks**

A group of 14 children were tested on their co-ordination skills and the results are shown on the scatter-plot below.



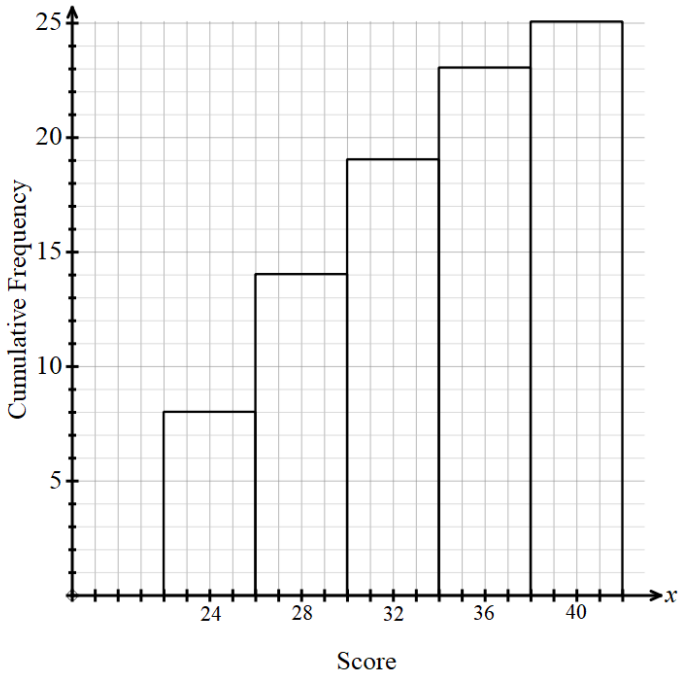
Two researchers, Anika and David, each draw a line of best fit on the graph.

(a) Explain why Anika's line is a better line of best fit. 1

(b) Give the equation of Anika's line. 2

Question 27 (4 marks) **Marks**

Sam recorded the scores of 25 footballers who each took 50 shots at goal. The cumulative frequency graph displays the results.



(a) Use the graph to estimate the median number of goals scored. 1

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(b) Calculate the mean number of goals scored. (Answer to 1 decimal place.) 1

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(c) What percentage of players scored 37 goals or more? 1

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(d) The players with the top 76% of scores go through to the next round of shots. What score was needed to go through to the next round? 1

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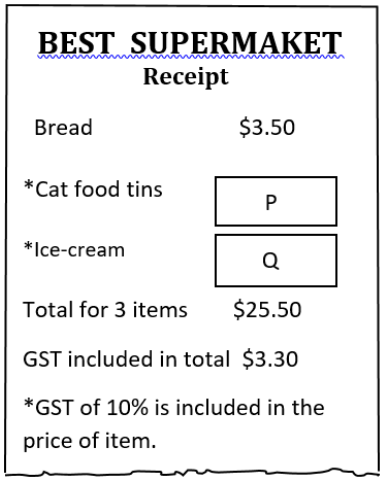
Question 28 (3 marks) **Marks**

A supermarket receipt is shown.



BEST SUPERMAKET
Receipt

Bread	$3.50
*Cat food tins	P
*Ice-cream	Q
Total for 3 items	$25.50
GST included in total	$3.30

*GST of 10% is included in the price of item.

Given that the cost of cat food tins is 3 times the cost of the ice-cream, determine the missing values P and Q to complete the receipt. 3

Question 29 (2 marks)

Julie is looking through the supermarket catalogue for her favourite cookies and cream ice-cream. She can buy 2L of triple-chocolate ice-cream for $6.30 while the cookies-and-cream ice-cream is usually $5.40 for 1.2L. What discount (in dollars and cents) should the supermarket offer on the price of the 1.2L container of cookies-and cream ice-cream for it to be of equal value to the 2L triple-chocolate container in per litre terms? 2

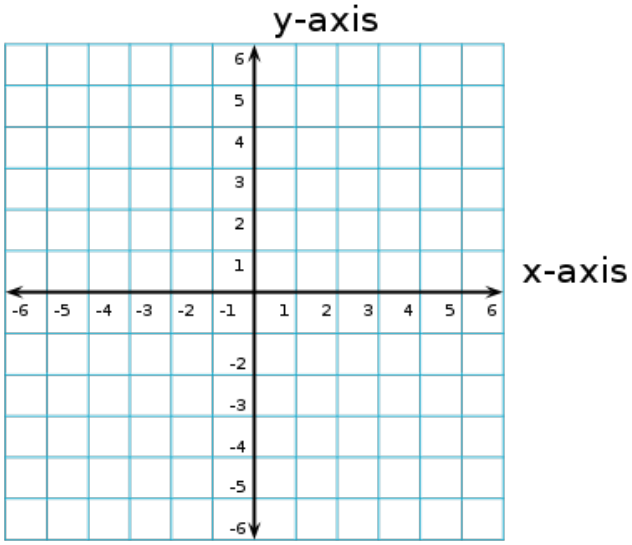
Question 30 (4 marks) **Marks**

(a) Make y the subject of the formula $3x - 5y + 10 = 0$. 1

(b) Using your answer in part (a) or otherwise, find the gradient and y-intercept of the linear equation: 1

$$3x - 5y + 10 = 0$$

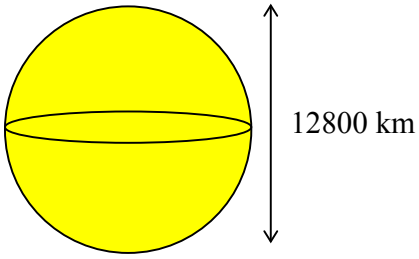
(c) Draw the linear function $3x - 5y + 10 = 0$ on the number plane given below: 2



Marks

Question 31 (4 marks)

The earth is in the shape of a sphere with the diameter of 12 800 km.



(a) Show that the circumference of the earth along equator is approximately 40000 km? 1

(b) A satellite is located 1000 km above sea level in space. How many km, to the nearest 100 km, does the satellite travel in each rotation? 1

(c) City A is located at (35°N, 125°E). City B is located 60° to the east and 40° to the south of city A. What is the latitude and longitude of city B? 2

Question 32 (2 marks)

Marks

(a) A bag contains more than three types of chocolates. In this bag there are 30 caramel pieces, 35 strawberry pieces, 20 mint pieces and many pieces of other flavours.

What is the ratio of caramel to strawberry to mint pieces, in its simplest form? 1

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(b) In this bag the ratio of the total number of caramel, strawberry and mint pieces to the total number of all the pieces in the bag is 17:18.

What is the total number of pieces of chocolate that are in the bag? 1

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Question 33 (4 marks)

In a particular game of chance, two dice are thrown. If both dice show a number greater than 4 then the person wins $2.50. If only one die shows a number greater than 4 the person wins $1.00. If both dice show numbers of 4 or less then the person loses $2.50.

(a) Draw a probability tree to show the possible outcomes. 2

(b) If the person played the game 10 times, what would be their expected winnings or loss? 2

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Question 34 (3marks) **Marks**

The heights, in metres, of 9 buildings in a small tourist area are as shown.
50, 54, 56, 58, 58, 68, 70, 74, 95

Is the height of the tallest building in this area considered an outlier? Justify your answer with calculations. 3

Question 35 (3 marks)

Rebecca has a credit card with the following conditions:

- There is no interest free period.
- Interest at the rate of 0.04% per day is charged at the end of each month.
- Interest is calculated from and including the date of purchase to the last day of the month.

Rebecca's credit card statement for August is shown, with some figures missing.

Statement period: 1 August to 31 August

Date	Details	Amount ($)
1 August	Opening balance	0
21 August	Fridge	4 500
31 August	Interest charge	
31 August	closing balance	

Minimum payment:

The minimum payment is calculated as 5% of the closing balance on the 31st of August. Calculate the minimum payment. 3

Question 36 (5 marks)

Marks

For a research assignment, Malcolm went to a forest near a river. He measured the circumference of eight trees and their distances from the riverbank.

His measurement results are summarised in the table.

Distance from the riverbank (m)	6	11	16	20	25	30	35	45
Circumference of tree (cm)	83	75	68	67	64	62	60	52

(a) Calculate Pearson's correlation coefficient for the data, correct to three decimal places. 2

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(b) Describe the correlation using the strength and the direction of the linear relationship between distance from the riverbank and the circumference of a tree. 2

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.....

(c) The equation of the least-squares regression line is shown.

$Circumference\ of\ a\ tree\ (cm) = -0.707 \times Distance\ from\ river\ (m) + 83.0$

A tree in this forest has a circumference of 56 cm.

Calculate the predicted distance, to the nearest metre, from this tree to the riverbank using the equation of the least-squares regression line.

1

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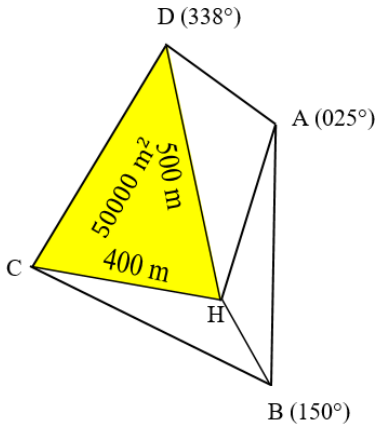
Question 37 (5 marks) **Marks**

A compass radial survey shows the positions of four bus stops relative to a house at the point H.



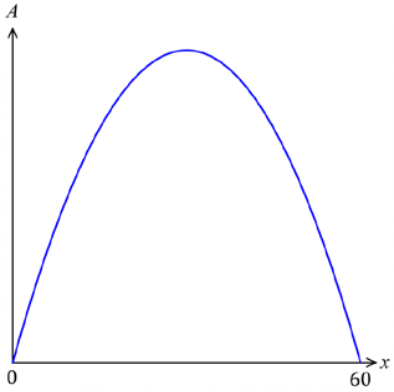
(a) What is the size of ∠DHA? 1

(b) If the distance from H to A is 300 m, calculate the length of DA to the nearest metre. 2

(b) Given that the area of the shaded acute-angled-triangle CHD is 50 000 m^2, calculate the size of $\angle DHC$. 2

Question 38 (2 marks) **Marks**

Thomas determines the area (A) in square metres of a rectangular farm by using the formula: $A = x(60 - x)$ where x represents the length of the farm (in metres).
Thomas draws a graph in the shape of a parabola representing this formula.



What is the maximum area (in square metres) of the farm? 2

Question 39 (3 marks)

The table below shows the mean and standard deviation in four HSC subjects.

Subject	Mean	Standard Deviation
English	65	10
Mathematics Standard	59	12
Society and Culture	55	8
Drama	68	15

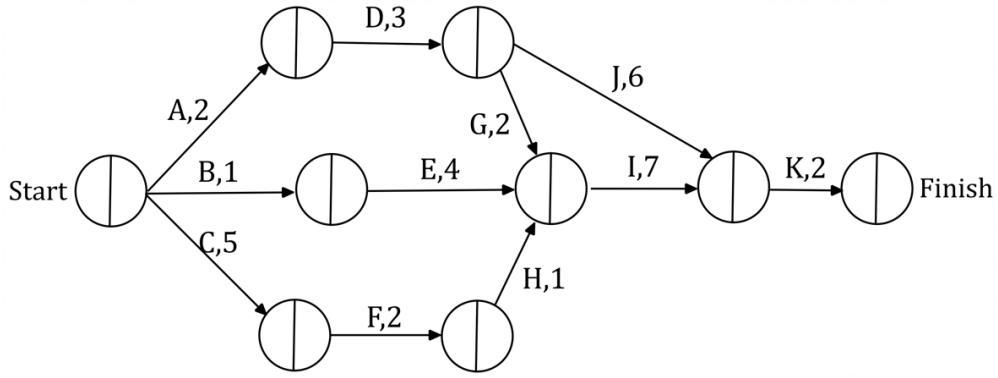
Kasey's marks were English 70, Mathematics Standard 66, Society and Culture 60 and Drama 79. In which subject did Kasey achieve the best result? 3

Question 40 (2 marks) **Marks**

A business makes batteries. A quality control check tested the number of hours the batteries lasted and found that the mean was 30 days and standard deviation 3.5 days. The results were normally distributed. What is the minimum number of days you would almost certainly expect a battery to last? Show all necessary working to justify your answer. 2

Question 41 (4 marks)

The following network shows the activities that are needed to complete a project and their completion times in hours.



(a) Fill in all the spaces with the earliest and the latest starting time for each activity, highlight the critical path and then find out the minimum time required to complete the above project. 3

(b) If activity *E* is delayed by 5 hours, then activity *K* will be delayed by how many hours? 1

Marks

Question 42 (5 marks)

The table shows the future values of an annuity of $1 for periods between 4 and 8 years, for different interest rates. The contributions are made at the end of each year.

Years	Interest Rate Per Annum				
	5%	6%	7%	8%	9%
4	4.3101	4.3746	4.4399	4.5061	4.5731
5	5.5256	5.6371	5.7507	5.8666	5.9847
6	6.8019	6.9753	7.1533	7.3359	7.5233
7	8.1420	8.3938	8.6540	8.9228	9.2004
8	9.5491	9.8975	10.2598	10.6366	11.0285

(a) An annuity account is opened with an interest rate of 5% per annum and contributions of $3000 are made at the end of each year for 5 years. 1

Calculate the value of the annuity after the last contribution is made.

(b) Using an annuity account with the same interest rate and contributions as above, calculate the size of the contributions necessary to achieve a value of $25 000 after 5 years. 2

(c) The table shows the present values of an annuity of $1 for periods between 58 and 62 months, for different interest rates. **Marks**

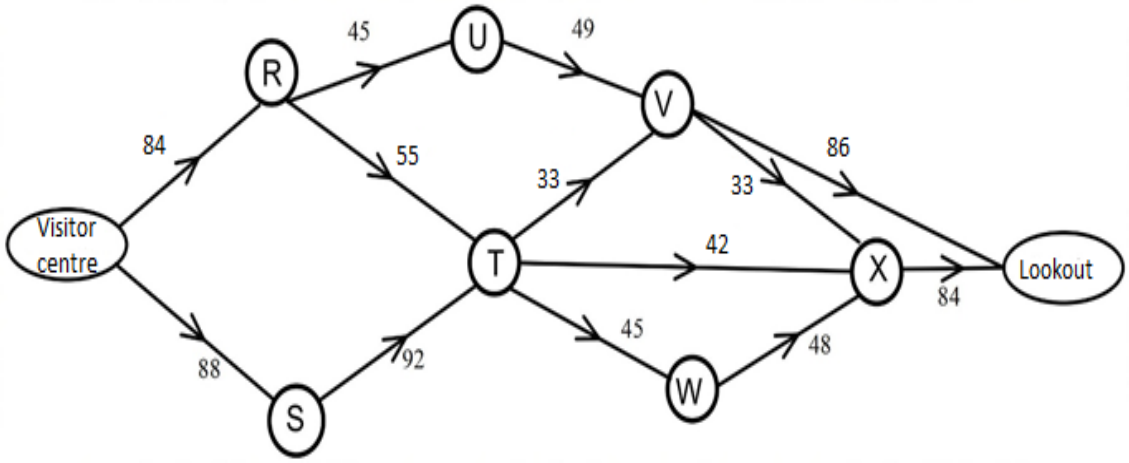
Months	Interest Rate Per Month				
	0.4%	0.5%	0.6%	0.7%	0.8%
58	51.67171	50.23911	48.86109	47.53525	46.25932
59	52.46186	50.98419	49.56370	48.19786	46.88425
60	53.24887	51.72556	50.26213	48.85587	47.50421
61	54.03274	52.46324	50.95639	49.50931	48.11926
62	54.81348	53.19726	51.64651	50.15820	48.72942

Use the table to calculate the monthly repayment needed on a loan of $20 000 at 7.2% per annum to be repaid over 5 years. 2

Question 43 (3 marks) **Marks**

To reduce congestion at Tao National Park, one-way trails are used to direct visitors from the Visitors Centre to the Lookout.

The network flow diagram below shows the layout of trails.



The trails pass through picnic areas which are labelled R through to X.

The capacity of each trail, in visitors per hour, is shown beside the trial.

Use minimum cut & maximum flow to find out the maximum flow of visitors from the Visitors Centre to the Lookout. Show all necessary working. 3

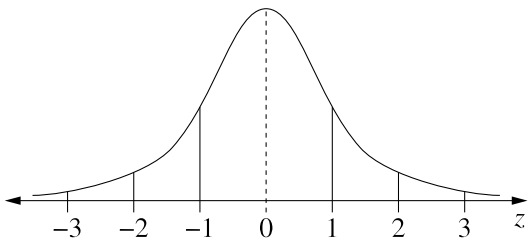
End of paper

Section II extra writing space

If you use this space, clearly indicate which question you are answering.

Section II extra writing space

If you use this space, clearly indicate which question you are answering.



z-scores between –3 and 3

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Number: _____

Section I

Trial Higher School Certificate Examination – 2019
Mathematics Standard 2

Multiple-choice Answer Sheet - Questions 1 – 15

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ● C ○ D ○

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ● B ⊗ C ○ D ○

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows:

correct ↙

A ⊗ B ⊗ C ○ D ○

1.	A	○	B	○	C	○	D ○
2.	A	○	B	○	C	○	D ○
3.	A	○	B	○	C	○	D ○
4.	A	○	B	○	C	○	D ○
5.	A	○	B	○	C	○	D ○
6.	A	○	B	○	C	○	D ○
7.	A	○	B	○	C	○	D ○
8.	A	○	B	○	C	○	D ○
9.	A	○	B	○	C	○	D ○
10.	A	○	B	○	C	○	D ○
11.	A	○	B	○	C	○	D ○
12.	A	○	B	○	C	○	D ○
13.	A	○	B	○	C	○	D ○
14.	A	○	B	○	C	○	D ○
15.	A	○	B	○	C	○	D ○

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Student Number:
Teacher:

St George Girls High School

Mathematics Standard 2

2020 Trial HSC Examination

General Instructions

- Reading time – 10 minutes
- Working Time – 2 hours and 30 minutes
- Write using black pen
- Calculators approved by NESA may be used
- A reference sheet is provided at the back of this paper
- For questions in **Section I**, use the multiple-choice answer sheet provided.
- For questions in **Section II**:
  - Answer the questions in the space provided
  - Show relevant mathematical reasoning and/or calculations
  - Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering
  - Marks may not be awarded for incomplete or poorly presented solutions

Total marks: 100

Section I – 15 marks (pages 3 – 9)

- Attempt Questions 1 - 15
- Allow about 25 minutes for this section

Section II – 85 marks qq

- Attempt Questions 16 – 43
- Allow about 2 hour and 5 minutes for this section

Section I

15 marks

Attempt questions 1 - 15

Allow about 25 minutes for this section

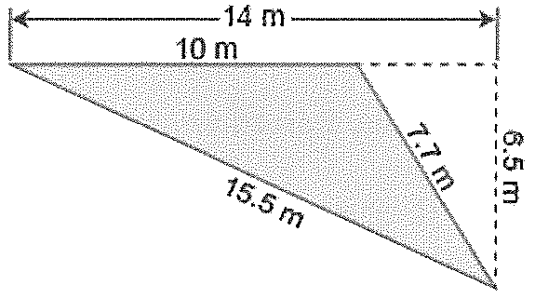
Use the multiple-choice answer sheet for questions 1-15

1. Hayley invests $4000 at 3% pa compounding monthly. What is the value of her investment (to the nearest dollar) after 5 years?

(A) $4 600.00
(B) $4637.10
(C) $4646.47
(D) $17599.16

$A = 4000 \times \left(1 + \frac{0.03}{12}\right)^{60}$
$= \$4646.47$ (nearest cent)

2. What is the area of this triangle in square metres?



$A = \frac{10 \times 6.5}{2}$
$= 32.5 \text{ m}^2$

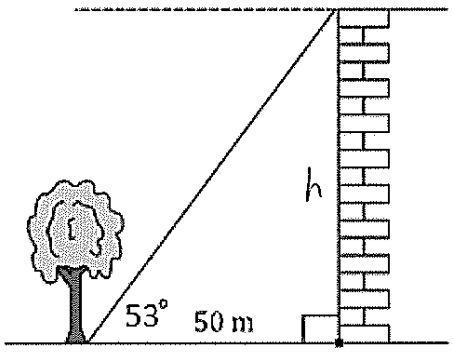
(A) 32.5
(B) 38.5
(C) 45.5
(D) 50.375

3. Jim, a landscaping contractor, charges by the hour for his company's services. To complete a particular job, he will have to use three workers and pay each of them $20 per hour. The fixed costs for the job are $150 and it will take four hours to complete the job. To break even on this job, his hourly charge to the client should be:

(A) $97.50
(B) $107.50
(C) $127.50
(D) $132.50

hourly rate $= \frac{3 \times 20 \times 4 + 150}{4}$
$= \$97.5 / \text{hour}.$

4. The angle of elevation from the base of the tree to the top of the building is 53°. The base of the building is 50 metres from the base of the tree.



$\tan 53^\circ = \frac{h}{50\,m}$

$50\,m \times \tan 53^\circ = h$

$h \doteq 66.35\,m$

$h \doteq 66\,m$

What is the height of the building, correct to the nearest metre?

(A) 30

(B) 40

(C) 66

(D) 67

5. The capacity of the fuel tank of Jane's car is 65 litres. She starts driving with a full tank and the car consumes 0.15 litres per km.
Which of the following linear equations describes the volume (V) in litres of fuel in the tank, after travelling k km?

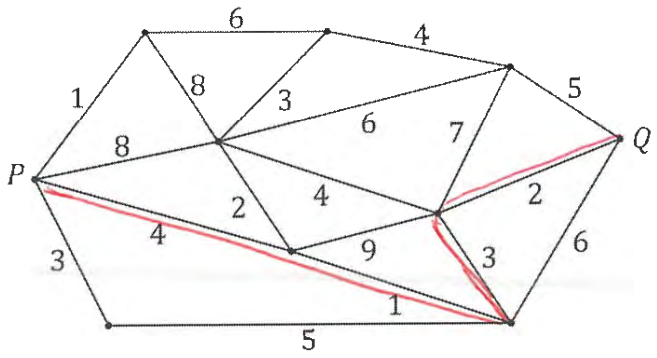
(A) $V = -0.15k - 65$

(B) $V = -0.15k + 65$

(C) $V = 0.15k + 65$

(D) $V = 0.15k - 65$

6. The following network shows the time, in hours, that it takes to travel along a series of roads that connect town P to town Q.



What is the shortest time, in hours, that it would take to travel from town P to town Q?

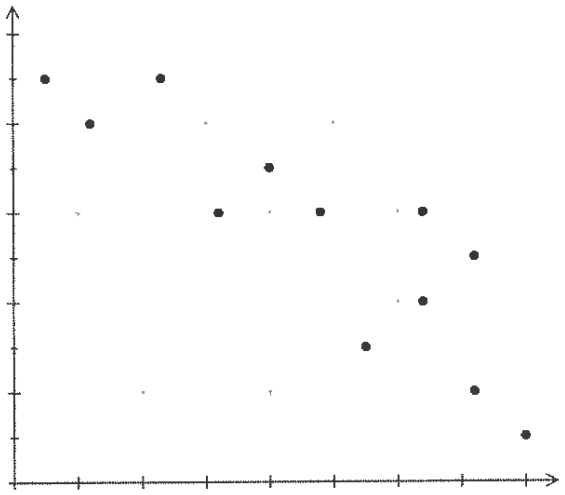
(A) 8

(B) 9

(C) 10

(D) 14

7.



The correlation coefficient of the above scatter plot is closest to:

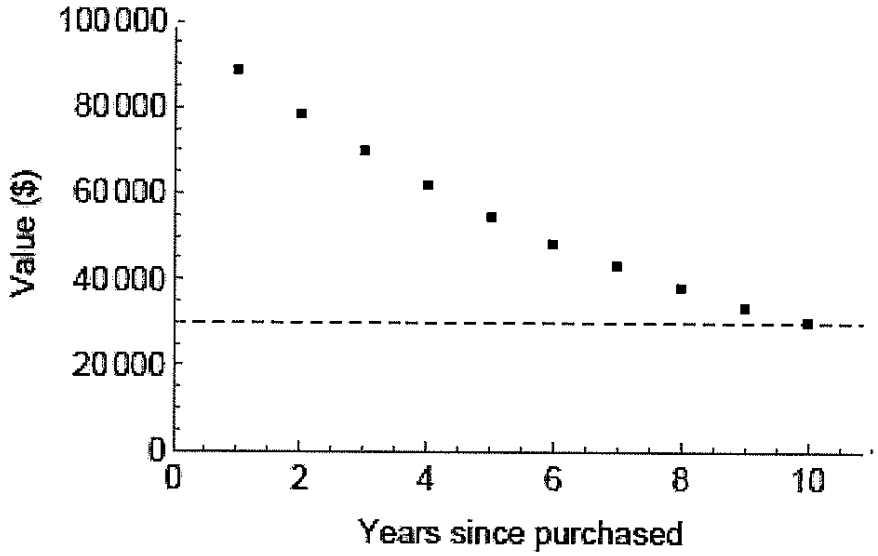
(A) 0.5

(B) -0.5

(C) 0.9

(D) -0.9

8. A large piece of machinery costs \$100 000 and is depreciated using the declining-balance method. The graph below shows the value of the machinery at the end of each year for ten years.



Which of the following statements is true?

(A) The rate of depreciation increases every year.

(B) Each year, the machinery depreciates by \$7000.

(C) The declining-balance depreciation rate is less than 10% per annum.

(D) The annual dollar value of the depreciation decreases over time.

9. Elizabeth lives in Sydney, NSW (UTC +10) and Margaret lives in Los Angeles, USA (UTC –8).

Margaret makes a call to Elizabeth at 12:30 pm on Monday 24th June.

What is the date and time in Sydney when Elizabeth receives the call?

(A) 6:30 pm Tuesday 25th

(B) 6:30 am Tuesday 25th

(C) 5:30 am Sunday 23rd

(D) 5:30 pm Monday 24th

12:30
+18:00
30:30
−24:00
6:30 am next day

10. The scale on an aerial photograph is given as 1 mm = 500 m. If the straight real distance between two towns is 1.2km, how far apart are these two towns on the map?

(A) 2.4 mm
(B) 24 mm
(C) 4.2 mm
(D) 0.42 mm

$1mm = 500m$ (÷1, ×)

$\frac{1 \times 1200}{500} mm = 1200 m$

11. Nick bought a portfolio of 500 OptusNet shares with his retrenchment payout.

The value of each share is currently \$52.50, and Nick is paid an annual dividend of \$2.75 per share.

What is the dividend yield on the shares?

(A) \$1375
(B) \$26250
(C) \$5.2%
(D) \$10.5%

$yield = \frac{2.75 \times 100}{52.50}$

$\doteqdot 5.2\%$

12. The length of a beach is measured as 1.45 km.

What is the absolute error of this measurement?

(A) 100 m
(B) 50 m
(C) 10 m
(D) 5 m

$1.45 km = 1450 m$.
smallest unit is 10 m.
$\pm \frac{10}{2} = 05 m$

13. Mitchell is going to buy a car and downloads data on fuel efficiency for three models.

Model	*Fuel Consumption (City)*	*Fuel Consumption (Country)*
Tacoma	15.8 L/100km	11.5 L/100km
Firenze	14.4 L/100km	11.4 L/100km
Vortex	15.6 L/100km	11.0 L/100km

In a test drive, he drives all three cars for 40 km on city roads and 120 km on country roads.

Based on the data, which car would use the least fuel on the test drive?

(A) The Firenze would use the least fuel

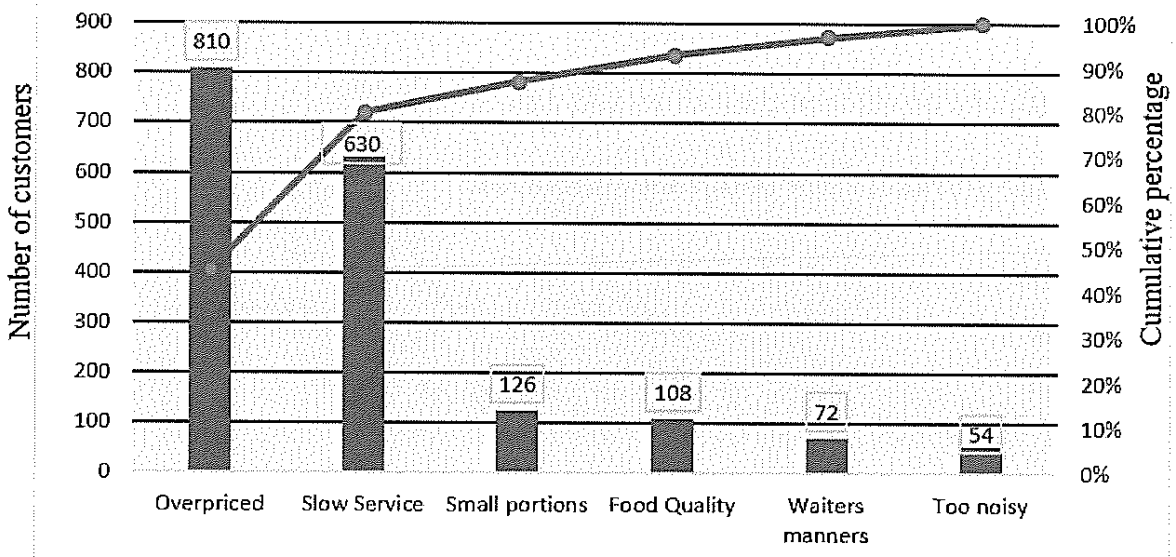
(B) The Firenze and the Tacoma are equal in using the least amount of fuel

(C) The Firenze and the Vortex are equal in using the least amount of fuel

(D) The Tacoma would use the least fuel

Tacoma: $\frac{15.8}{2.5} + 11.5 \times 1.2 = 20.12$ L | Firenze $\frac{14.4}{2.5} + 11.4 \times 1.2 = 19.44$ L | Vortex $\frac{15.6}{2.5} + 11 \times 1.2 = 19.44$ L

14. A restaurant owner collected data related to the reasons given by customers for being unhappy with his restaurant. The Pareto chart shows the data collected.



Which percentage of customers were unhappy because of the small portions?

$\frac{126}{810+630+126+108+72+54} \times 100 \doteqdot 7\%$

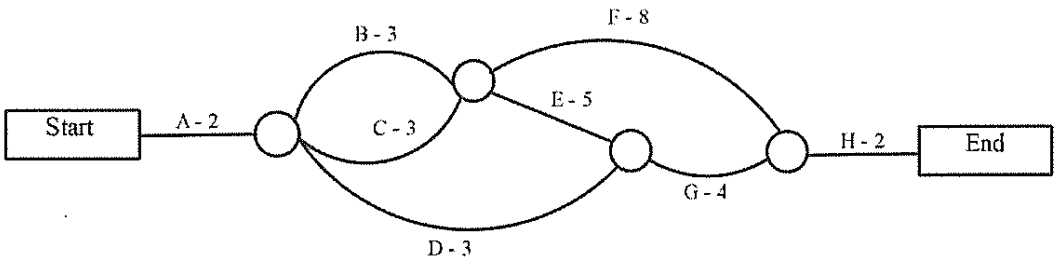
(A) 6% (B) 7% (C) 8% (D) 87%

15. The activity chart below shows the immediate prerequisite(s) and duration for each activity in a project.

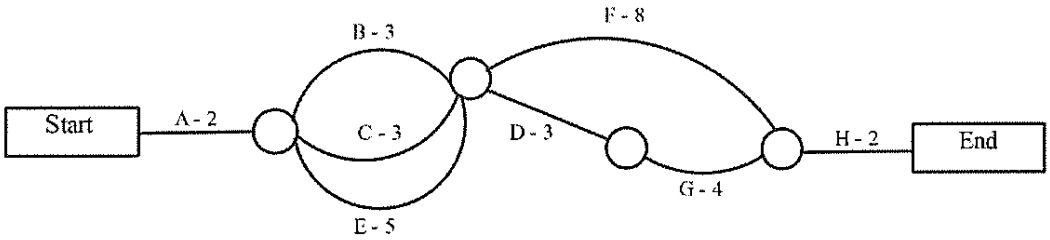
Activity	Immediate Prerequisites	Time (days)
A	-	2
B	A	3
C	A	3
D	B, C	3
E	A	5
F	B, C	8
G	D, E	4
H	F, G	2

Which network could be drawn from the activity chart?

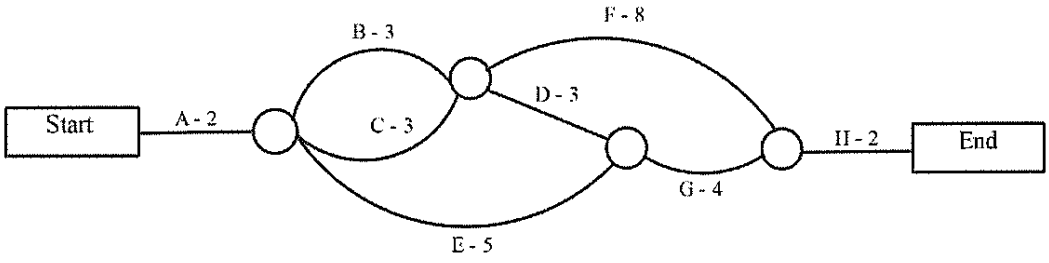
(A)



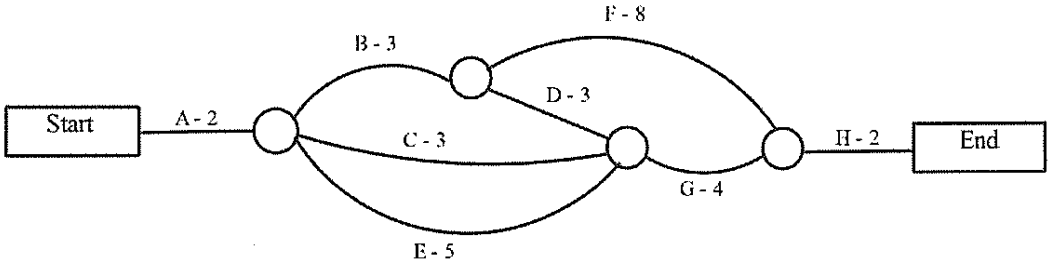
(B)



(C)



(D)



End of Section I

Section II

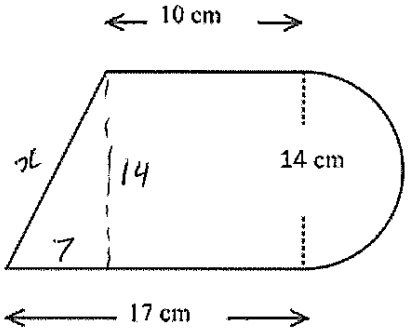
85 marks
Attempt all questions
Allow about 2 hours and 5 minutes for this section

Answer the questions in the spaces provided.

Your responses should include relevant mathematical reasoning and/or calculations.
Extra writing space is provided at the back of the examination paper.

Question 16 (2 mark) **Marks**

Calculate the perimeter of the shape below, rounded to 3 significant figures. 2



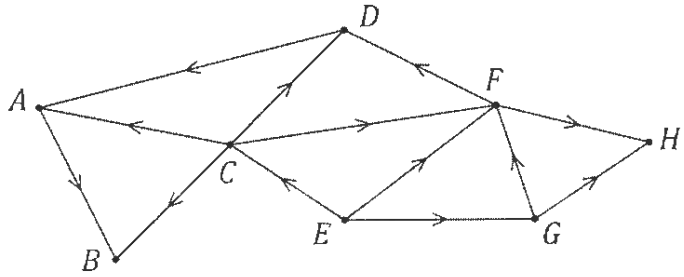
Arc $= \frac{\pi D}{2}$
$= \frac{\pi \times 14}{2}$
$= 7\pi$ cm.

$x^2 = 7^2 + 14^2$
$x = \sqrt{49 + 196}$
$= \sqrt{245}$
$= 15.65247...$

Perimeter $= x + 10 + \text{arc} + 17$
$= 15.65 + 10 + 7\pi + 17$
$\doteq 64.6$ cm (3 sig. fig.)

Question 17 (2 marks) **Marks**

A maze contains eight statues. The statues are labelled A to H on the following directed graph. Walkers within the maze are only allowed to move in the directions of the arrows.



(a) Find two statues that a walker could not reach from statue G. 1

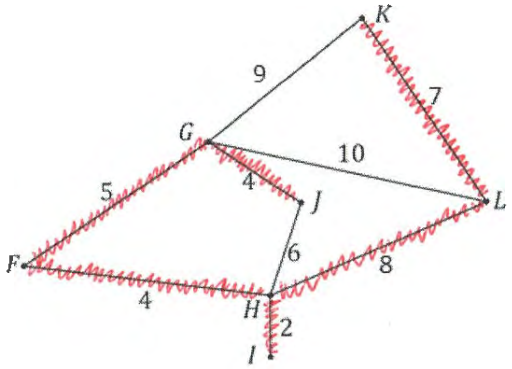
E & C

(b) One way that statue D can be reached from statue E is along path ECD. List two other ways that statue D can be reached from statue E. 1

EFD, EGFD

Question 18 (3 marks)

The network diagram shows seven campsites, F, G, H, I, J, K and L, which are joined by tracks. The numbers by the paths show lengths (in km) of that section of track.

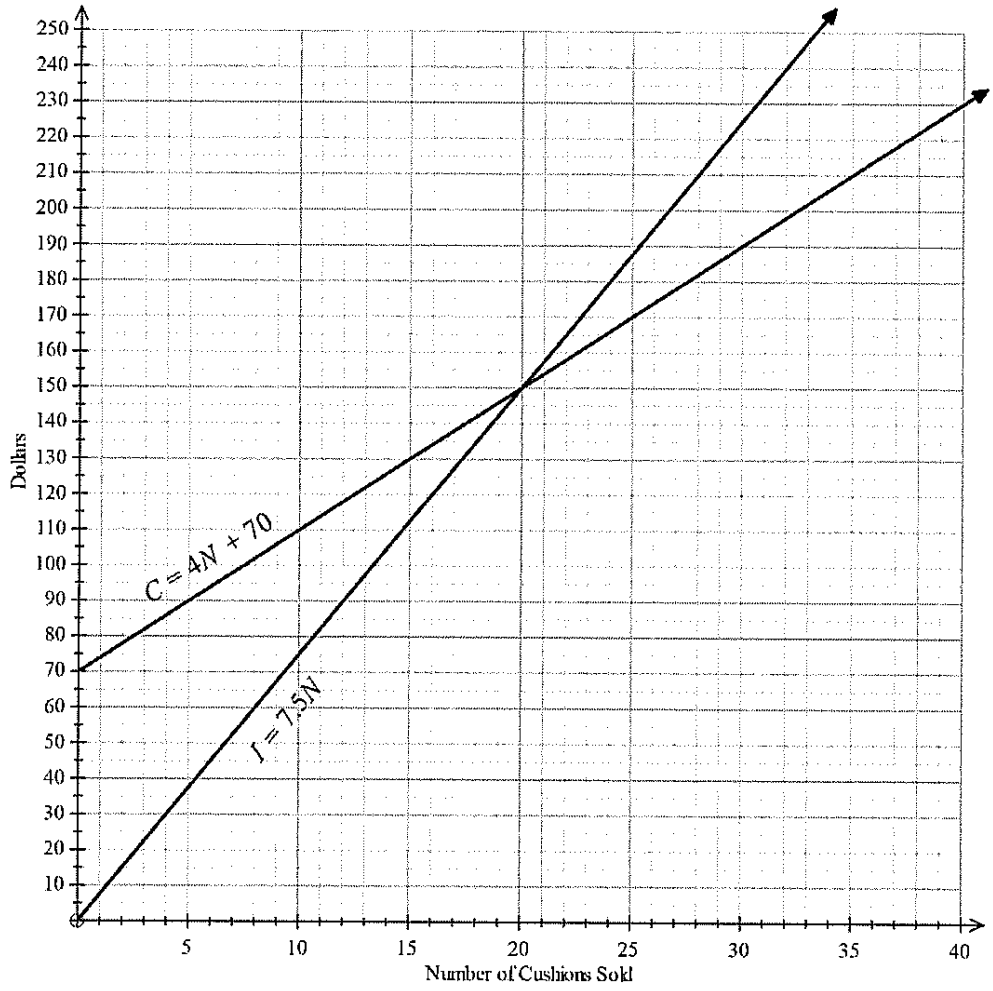


(a) Find and highlight the minimum spanning tree of the network. 2

(b) A telephone cable is to be laid along as few of the existing tracks as possible. What is the minimum length of cable necessary to complete this task? 1

Question 19 (2 marks) **Marks**

An online retailer of cushions draws the graph below to analyse sales. The lines representing the equations for daily cost (C) and daily income (I) are shown.



(a) Give an appropriate explanation for what the coefficient of N i.e. 4, could mean in the equation $C = 4N + 70$ 1

The 4, which is the coefficient of N, represent the cost of each additional item, in addition to the fixed cost of $70/day.

(b) What is the result on a day where 30 cushions were sold? 1

When $N = 30$; $C = 4N + 70$ & $I = 7.5 \times N$

$= 4 \times 30 + 70$ $= 7.5 \times 30$

$= \$190$ $= \$225$

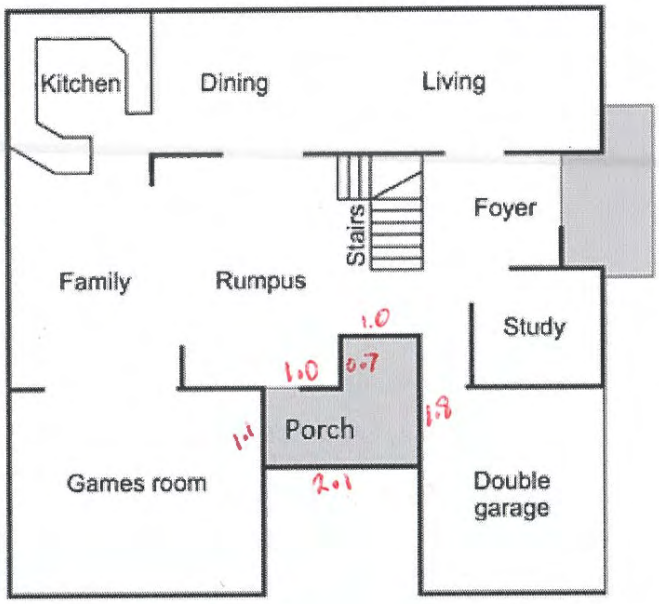
Profit $= I - C$

$= 225 - 190$

$= \$35$

Question 20 (4 marks) **Marks**

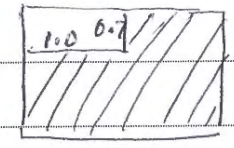
The house plan of the ground floor is drawn below.



(a) The north side of the house which has Dining and Living is 12m long. What is the scale of the house plan? 1

80 mm on map = 12 m on ground.
80 mm on map = 12000 mm on ground
80 : 12000
1 : 150 (scale)

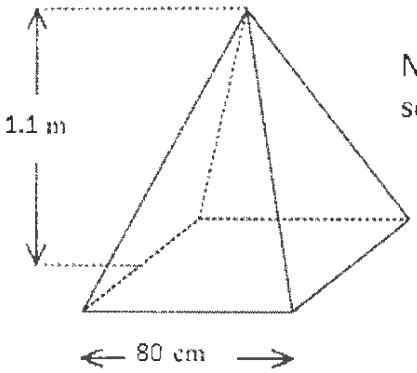
(b) What is the cost of tiling the area that is labelled as porch on the south side, if tiling costs \$150 per square metre? 3



Area = $2.1 \times 150 \times 1.8 \times 150 - 0.7 \times 150 \times 1 \times 150$ cm^2
$= 85050 - 15750$ cm^2
$= 69300$ cm^2
$= 6.93$ m^2
Cost $= 6.93 \times 150$
$= \$1039.50$

Question 21 (2 marks) **Marks**

A pyramid has a vertical height of 1.1 m, and it has a square base of 80 cm.



Not to scale

Calculate the capacity of the pyramid in litres. 2

$V = \frac{1}{3} \times$ base area $\times$ height.

$= \frac{1}{3} \times 0.8 \times 0.8 \times 1.1$

$= 0.2346\dot{6}\ m^3$

$= 235$ Litres

Question 22 (2 marks)

The formula below gives the blood alcohol concentration for a male.

$$BAC_{\text{Male}} = \frac{10N - 7.5H}{6.8M}$$

where N is the number of standard drinks consumed, H is the number of hours of drinking, and M is the person's weight in kilograms.
Charles weighs 70 kg and consumes 4 standard drinks in 2 hours.
What is his BAC, correct to 2 significant figure? 2

$BAC_{(M)} = \frac{4 \times 10 - 7.5 \times 2}{6.8 \times 70}$

$= 0.053$ (2 sig. fig)

Question 23 (2 marks) **Marks**

What is the least amount (to the nearest dollar) that must be invested now at 4.8% per annum, compounded monthly, so that in three years it will have grown to \$25 000? 2

$$\text{Future Value} = \text{Present Value}(1+r)^n$$

$$25000 = P\left(1+\frac{0.048}{12}\right)^{3\times 12}$$

$$25000 = P(1.004)^{36}$$

$$P = \frac{25000}{1.004^{36}}$$

$$\div \$21653.41$$

$$\div 21654 \quad \text{(rounding up to reach the target)}$$

Question 24 (2 marks)

Angel sets up this spreadsheet to track the progress of her loan on a monthly basis.

Principal (P) = \$45 000.00			This table assumes each month is one twelfth of a year.	
Annual Interest rate (r) = 8%				
Monthly repayment (R) = \$500.00				
N	Principal (P)	Interest (I)	*P + I*	*P + I - R*
1	\$45,000.00	\$300.00	\$45,300.00	\$44,800.00
2	\$44,800.00	\$298.67	\$45,098.67	\$44,598.67
3	\$44,598.67	\$297.32	\$44,895.99	\$44,395.99
4	\$44,395.99	\$295.97	\$44,691.96	\$44,191.96
5	\$44,191.96			**Y**

Calculate the value that would appear at **Y**. 2

$$\text{monthly rate} = \frac{8}{12}\% \text{ or } \frac{2}{3}\%$$

$$I = 44191.96 \times \frac{8}{1200}$$

$$= \$294.61$$

$$P+I = \$44191.96 + \$294.61$$

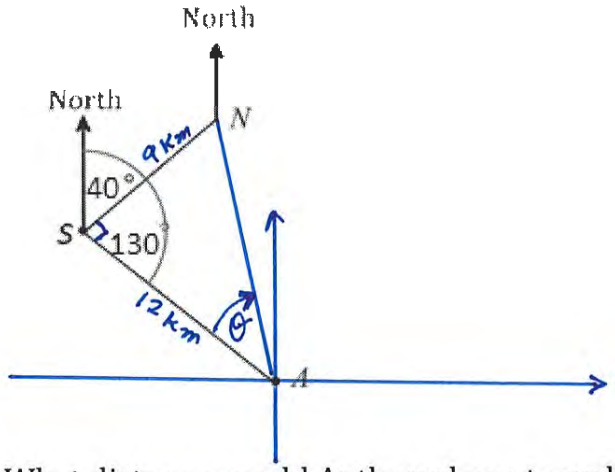
$$= 44486.57$$

$$Y = 44486.57 - 500$$

$$= \$43986.57$$

Question 25 (3 marks) **Marks**

Anthony and Natalie walk in different directions from the same camp site (***S***). Anthony walks for 12 km on a bearing of 130° to a lookout (***N***) and Natalie walks for 9 km on a bearing of 040° to a picnic ground (***A***). Anthony then walks directly from the lookout to meet Natalie at the picnic ground.



(a) What distance would Anthony have to walk to meet Natalie on the lookout point? 1

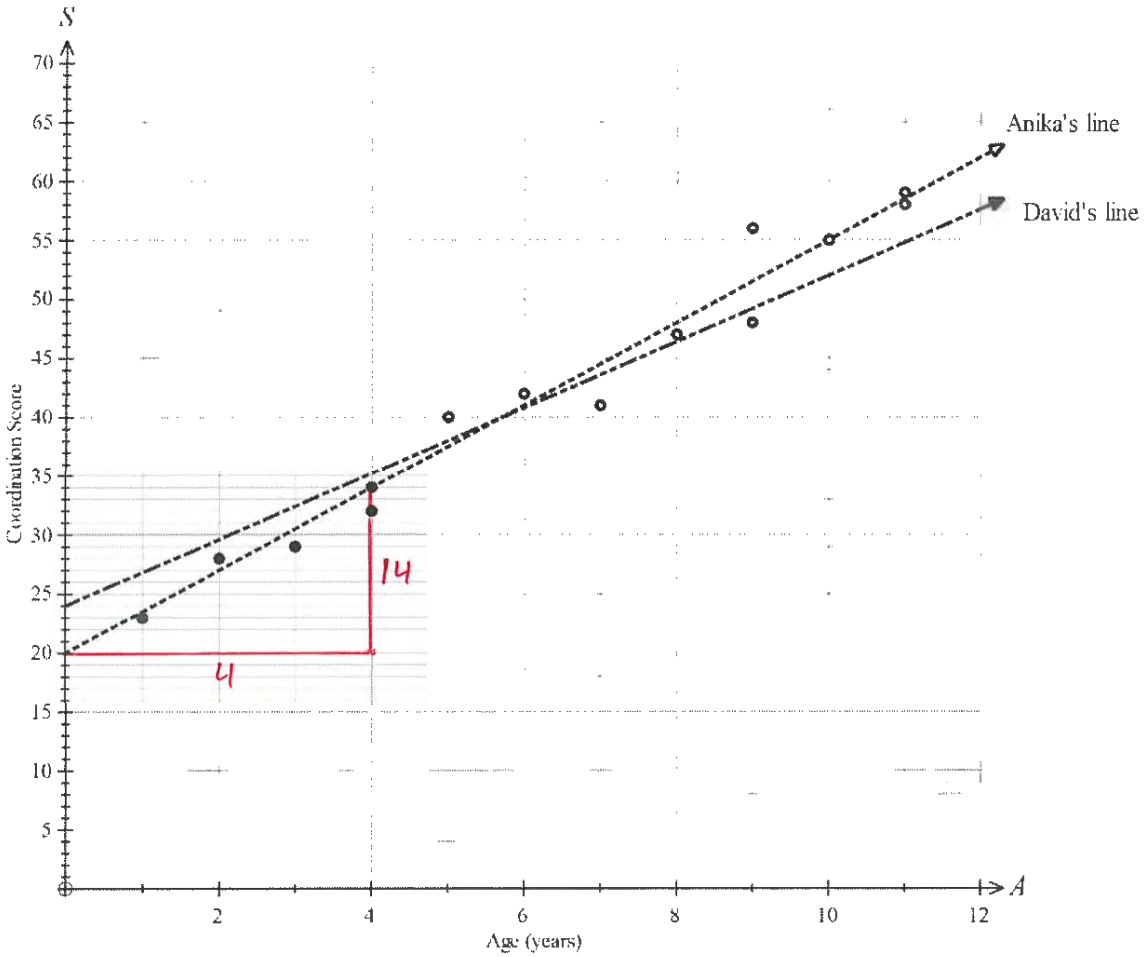
$\angle ASN = 130° - 40°$
$= 90°$
$AN^2 = 9^2 + 12^2$
$AN = \sqrt{81+144}$
$= \sqrt{225}$
$= 15$ Km

(b) On what bearing must Anthony walk? 2

$\tan\theta = \frac{9}{12}$
$\theta = \tan^{-1}\left(\frac{9}{12}\right)$
$= 37°$ (nearest degree)
A to N Bearing $= 180° + 130° + 37°$
$= 347°$

Question 26 (3 marks) **Marks**

A group of 14 children were tested on their co-ordination skills and the results are shown on the scatter-plot below.



Two researchers, Anika and David, each draw a line of best fit on the graph.

(a) Explain why Anika's line is a better line of best fit. 1

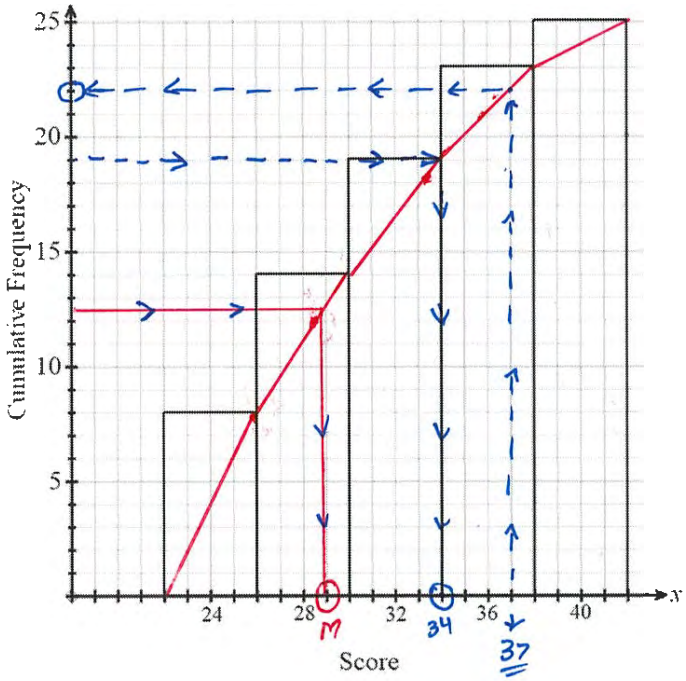
Anika's line touches 5 points while David's line touches only one point. While drawing the line Anika has made sure that average or aggregate distance of other points are much smaller in comparison to that of David's line.

(b) Give the equation of Anika's line. $m = \frac{7}{2}$ 2

$y = \frac{7}{2}A + 20$

Question 27 (4 marks) **Marks**

Sam recorded the scores of 25 footballers who each took 50 shots at goal. The cumulative frequency graph displays the results.



(a) Use the graph to estimate the median number of goals scored. 1

29

(b) Calculate the mean number of goals scored. (Answer to 1 decimal place.) 1

$\bar{x} = \frac{24\times8 + 28\times6 + 32\times5 + 36\times4 + 40\times2}{25}$

$\fallingdotseq 29.8$

(c) What percentage of players scored 37 goals or more? 1

3 students scored 37 or more.

$\frac{3}{25} = 12\%$

(d) The players with the top 76% of scores go through to the next round of shots. What score was needed to go through to the next round? 1

$76\% = \frac{19}{25}$

all players with 34 or more goals move to the next round of shots.

∴ 34 or more goals.

Question 28 (3 marks) **Marks**

A supermarket receipt is shown.

BEST SUPERMAKET
Receipt

Bread	$3.50
*Cat food tins	P
*Ice-cream	Q
Total for 3 items	$25.50
GST included in total	$3.30

*GST of 10% is included in the price of item.

Given that the cost of cat food tins is 3 times the cost of the ice-cream, determine the missing values P and Q to complete the receipt. 3

$P + Q = \$25.30 - \$3.50$
$= \$22$

$P + Q = 3Q + Q$
$22 = 4Q$
$Q = \$5.50$ (ice-cream)
$3Q$ or $P = 3 \times 5.50$
$= \$16.50$ (cat food tins)

Question 29 (2 marks)

Julie is looking through the supermarket catalogue for her favourite cookies and cream ice-cream. She can buy 2L of triple-chocolate ice-cream for $6.30 while the cookies-and-cream ice-cream is usually $5.40 for 1.2L. What discount (in dollars and cents) should the supermarket offer on the price of the 1.2L container of cookies-and cream ice-cream for it to be of equal value to the 2L triple-chocolate container in per litre terms? 2

2 L triple-chocolate cost is $6.30, ∴ $3.15/L
1.2L C&Cr cost is $5.40, ∴ $4.50/L

Difference is $4.50 − $3.15
$= \$1.35$/Litre.
∴ discount need on cookies & Cream $= \$1.35/L$
or $\$1.35 \times 1.2$ L
$= \$1.62$

Question 30 (4 marks) **Marks**

(a) Make y the subject of the formula $3x - 5y + 10 = 0$. (+5y) 1

$3x + 10 = 5y$

$y = \frac{3}{5}x + 2$

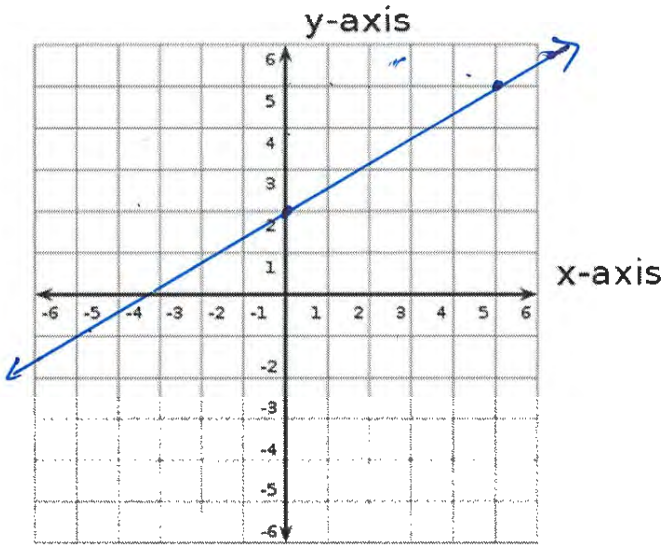
(b) Using your answer in part (a) or otherwise, find the gradient and y-intercept of the linear equation: 1

$$3x - 5y + 10 = 0$$

gradient $(m) = \frac{3}{5}$

y-int $(c) = 2$

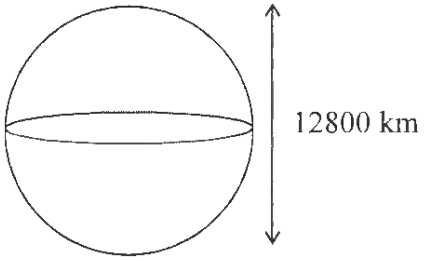
(c) Draw the linear function $3x - 5y + 10 = 0$ on the number plane given below: 2



Marks

Question 31 (4 marks)

The earth is in the shape of a sphere with the diameter of 12 800 km.



(a) Show that the circumference of the earth along equator is approximately 40000 km? 1

$C = \pi D$

$= \pi \times 12800$ km

$= 402212.39...$

$\doteqdot 40000$ km

(b) A satellite is located 1000 km above sea level in space. How many km, to the nearest 100 km, does the satellite travel in each rotation? 1

$C = \pi(12800 + 1000 \times 2)$

$= \pi \times 14800$

$= 46495.57..$ km

$\doteqdot 46500$ km

(c) City A is located at (35°N, 125°E). City B is located 60° to the east and 40° to the south of city A. What is the latitude and longitude of city B? 2

$35°N \quad 125E$
$-40 \quad +60$

City B is at $(-5°N, 185°E)$
$(5°S, 175°W)$

$\therefore$ city B is at $(5°S, 175°W)$

Question 32 (2 marks) **Marks**

(a) A bag contains more than three types of chocolates. In this bag there are 30 caramel pieces, 35 strawberry pieces, 20 mint pieces and many pieces of other flavours.

What is the ratio of caramel to strawberry to mint pieces, in its simplest form? 1

C : S : M
30 : 35 : 20 ÷5
6 : 7 : 4

(b) In this bag the ratio of the total number of caramel, strawberry and mint pieces to the total number of all the pieces in the bag is 17:18. 1

What is the total number of pieces of chocolate that are in the bag?

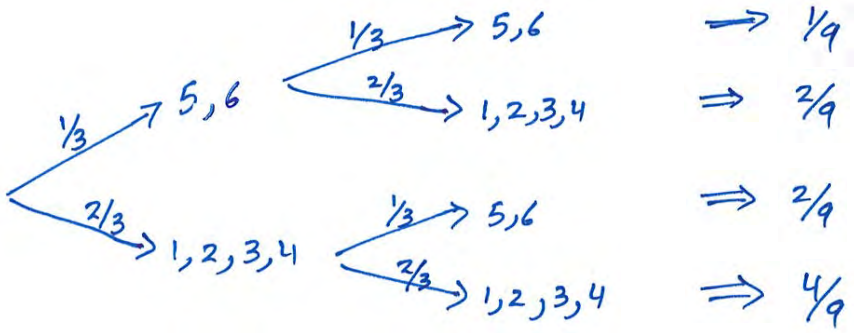
6+7+4 = 17
C+S+M : Total
17 : 18

When 17 Shares = 85
18 shares = 90
∴ total 90 chocolates.

Question 33 (4 marks)

In a particular game of chance, two dice are thrown. If both dice show a number greater than 4 then the person wins \$2.50. If only one die shows a number greater than 4 the person wins \$1.00. If both dice show numbers of 4 or less then the person loses \$2.50.

(a) Draw a probability tree to show the possible outcomes. 2



(b) If the person played the game 10 times, what would be their expected winnings or loss? 2

Expected win/loss = 10 (1/9 × 2.50 + 4/9 × 1 − 4/9 × 2.5)
= 10 × −7/18
= loss of \$3.89

Question 34 (3marks) **Marks**

The heights, in metres, of 9 buildings in a small tourist area are as shown.
50, 54, 56, 58, 58, 68, 70, 74, 95
Q1 M Q3

Is the height of the tallest building in this area considered an outlier? Justify your answer with calculations. 3

$Q1 = 55$, $Q3 = 72$

$IQR = 72 - 55$
$= 17$

outlier $> 1.5 \times 17 + Q3$
outlier $> 1.5 \times 17 + 72$
> 97.5

$\therefore$ 95 is not an outlier.

Question 35 (3 marks)

Rebecca has a credit card with the following conditions:

- There is no interest free period.
- Interest at the rate of 0.04% per day is charged at the end of each month.
- Interest is calculated from and including the date of purchase to the last day of the month.

Rebecca's credit card statement for August is shown, with some figures missing.

Statement period: 1 August to 31 August

Date	Details	Amount ($)
1 August	Opening balance	0
21 August	Fridge	4 500
31 August	Interest charge	
31 August	closing balance	

Minimum payment:

No. of days counted for interest = 11

The minimum payment is calculated as 5% of the closing balance on the 31st of August. Calculate the minimum payment. 3

$I = 4500 \times 0.04\% \times 11$
$= \$19.80$

closing Balance $= \$4500 + \$19.80$
$= \$4519.80$

Minimum payment $= 0.05 \times \$4519.80$
$= \$225.99$

Question 36 (5 marks)

Marks

For a research assignment, Malcolm went to a forest near a river. He measured the circumference of eight trees and their distances from the riverbank.

His measurement results are summarised in the table.

Distance from the riverbank (m)	6	11	16	20	25	30	35	45
Circumference of tree (cm)	83	75	68	67	64	62	60	52

(a) Calculate Pearson's correlation coefficient for the data, correct to three decimal places. 2

$r = -0.967$ (3 d.p)

(b) Describe the correlation using the strength and the direction of the linear relationship between distance from the riverbank and the circumference of a tree. 2

There is a strong negative correlation between distance from the riverbank and the circumference of a tree

(c) The equation of the least-squares regression line is shown.

$$Circumference\ of\ a\ tree\ (cm) = -0.707 \times Distance\ from\ river\ (m) + 83.0$$

A tree in this forest has a circumference of 56 cm.

Calculate the predicted distance, to the nearest metre, from this tree to the riverbank using the equation of the least-squares regression line. 1

$c = -0.707 \times d + 83.0$

$56 = -0.707 \times d + 83$

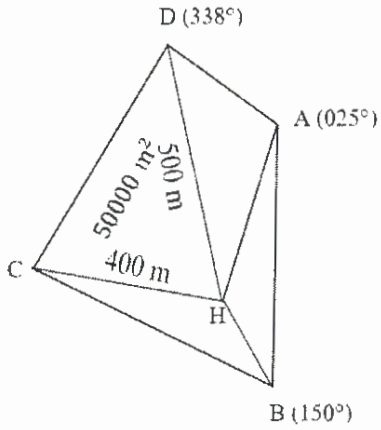
$-27 = -0.707d$

$d = \frac{27}{0.707}$

$d \doteq 38\ m$

Question 37 (5 marks) **Marks**

A compass radial survey shows the positions of four bus stops relative to a house at the point H.



(a) What is the size of ∠DHA? 1

$\angle DHA = (360° - 338°) + 025°$

$= 47°$

(b) If the distance from H to A is 300 m, calculate the length of DA to the nearest metre. 2

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

$c = \sqrt{500^2 + 300^2 - 2 \times 500 \times 300 \times \cos 47°}$

$= 367.968\ldots\ m$

$\doteq 368\ m$

(b) Given that the area of the shaded acute-angled-triangle CHD is 50 000 m², calculate the size of ∠*DHC*. 2

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

$5000\ m^2 = \frac{1}{2} \times 400 \times 500 \times \sin C$

$\sin C = \frac{5000}{200 \times 500}$

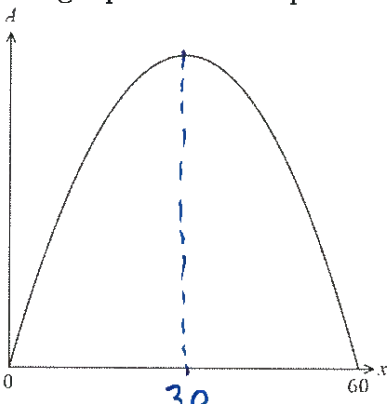
$\sin C = \frac{1}{2}$

$C = \sin^{-1}\left(\frac{1}{2}\right)$

$\therefore \angle DHC = 30°$

Question 38 (2 marks) **Marks**

Thomas determines the area (A) in square metres of a rectangular farm by using the formula: $A = x(60 - x)$ where x represents the length of the farm (in metres).
Thomas draws a graph in the shape of a parabola representing this formula.



$\frac{0+60}{2}$

$x = 30$ at maximum point

What is the maximum area (in square metres) of the farm? 2

Maximum Area $= 30(60-30)$
$= 30 \times 30$
$= 900\ m^2$

Question 39 (3 marks)

The table below shows the mean and standard deviation in four HSC subjects.

Subject	Mean	Standard Deviation
English	65	10
Mathematics Standard	59	12
Society and Culture	55	8
Drama	68	15

Kasey's marks were English 70, Mathematics Standard 66, Society and Culture 60 and Drama 79. In which subject did Kasey achieve the best result? 3

$z(E) = \frac{70-65}{10}$
$= \frac{1}{2}$

$z(S\&C) = \frac{60-55}{8}$
$= 5/8$
$= 0.625$

$z(M) = \frac{66-59}{12}$
$= \frac{7}{12}$
$= 0.583\dot{}$

$z(D) = \frac{79-68}{15}$
$= \frac{11}{15}$
$= 0.73\dot{}$

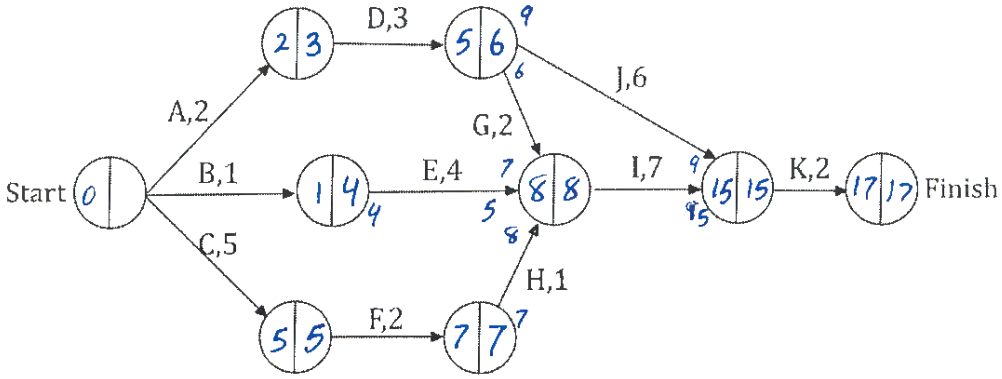
Question 40 (2 marks) **Marks**

A business makes batteries. A quality control check tested the number of hours the batteries lasted and found that the mean was 30 days and standard deviation 3.5 days. The results were normally distributed. What is the minimum number of days you would almost certainly expect a battery to last? Show all necessary working to justify your answer. 2

3 x 3.5 = 10.5 (for −3 standard deviation)
∴ 30 − 10.5 = 19.5 day is 3 SD below mean
Only 0.15% of 3 in 2000 batteries will last less than 19.5 days. 99.85% is almost certain in probability.
∴ It is almost certain that a battery will last at least 19½ or 20 days.

Question 41 (4 marks)

The following network shows the activities that are needed to complete a project and their completion times in hours.



(a) Fill in all the spaces with the earliest and the latest starting time for each activity, highlight the critical path and then find out the minimum time required to complete the above project. 3

17 hours.

(b) If activity *E* is delayed by 5 hours, then activity *K* will be delayed by how many hours? 1

Float time for activity E is 3 hours.
If E gets delayed by 5 hours, K will be delayed by 2 hours.

Marks

Question 42 (5 marks)

The table shows the future values of an annuity of $1 for periods between 4 and 8 years, for different interest rates. The contributions are made at the end of each year.

Years	Interest Rate Per Annum				
	5%	6%	7%	8%	9%
4	4.3101	4.3746	4.4399	4.5061	4.5731
5	5.5256	5.6371	5.7507	5.8666	5.9847
6	6.8019	6.9753	7.1533	7.3359	7.5233
7	8.1420	8.3938	8.6540	8.9228	9.2004
8	9.5491	9.8975	10.2598	10.6366	11.0285

(a) An annuity account is opened with an interest rate of 5% per annum and contributions of $3000 are made at the end of each year for 5 years. 1

Calculate the value of the annuity after the last contribution is made.

Future Value of the annuity
$= 5.5256 \times 3000$
$= \$16576.80$

(b) Using an annuity account with the same interest rate and contributions as above, calculate the size of the contributions necessary to achieve a value of $25 000 after 5 years. 2

F.V. =
$25000 = 5.5256 \times C$

$C = \dfrac{25000}{5.5256}$

$= \$4524.40$

(c) The table shows the present values of an annuity of \$1 for periods between 58 and 62 months, for different interest rates. **Marks**

Months	Interest Rate Per Month				
	0.4%	0.5%	0.6%	0.7%	0.8%
58	51.67171	50.23911	48.86109	47.53525	46.25932
59	52.46186	50.98419	49.56370	48.19786	46.88425
60	53.24887	51.72556	50.26213	48.85587	47.50421
61	54.03274	52.46324	50.95639	49.50931	48.11926
62	54.81348	53.19726	51.64651	50.15820	48.72942

Use the table to calculate the monthly repayment needed on a loan of \$20 000 at 7.2% per annum to be repaid over 5 years. 2

\$1 annuity = \$50.26213 P.V. ÷ 1

$\frac{1 \times 20000}{50.26213}$ = \$20000 P.V ×

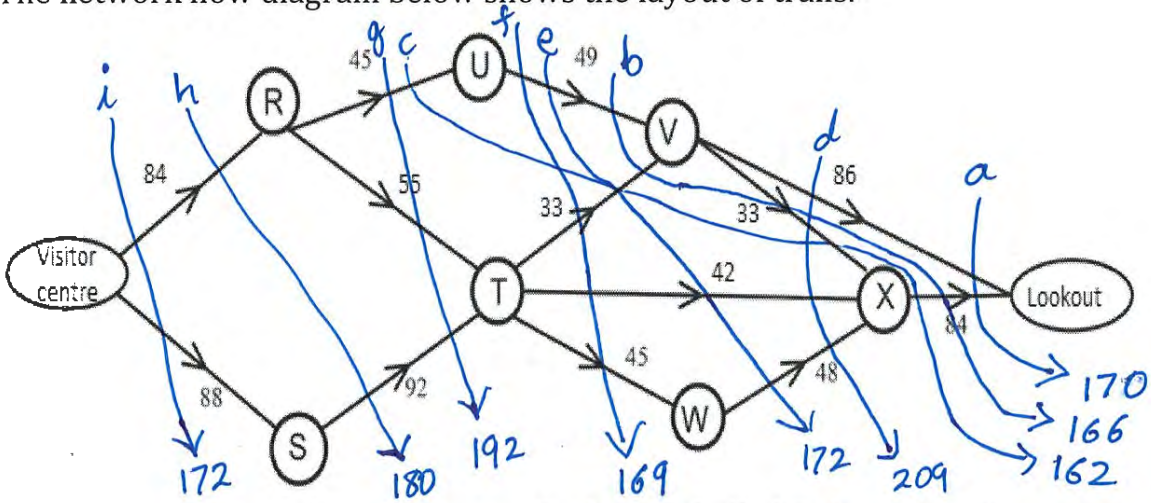
∴ \$1 annuity = $\frac{\$20000}{50.26213}$

= \$397.91/month.

Question 43 (3 marks) **Marks**

To reduce congestion at Tao National Park, one-way trails are used to direct visitors from the Visitors Centre to the Lookout.

The network flow diagram below shows the layout of trails.



The trails pass through picnic areas which are labelled R through to X.

The capacity of each trail, in visitors per hour, is shown beside the trial.

Use minimum cut & maximum flow to find out the maximum flow of visitors from the Visitors Centre to the Lookout. Show all necessary working. 3

The cut 'c' as shown in the above diagram allows only 162 people as the minimum cut.
Therefore the maximum capacity of the possible flow for the trail is 162 people.

End of paper