Name:……

Teacher's Name:……

Pymble Ladies' College

HIGHER SCHOOL CERTIFICATE
TRIAL EXAMINATION
2020

Mathematics Standard 2

Section I
Multiple Choice Questions

15 marks
Attempt Questions 1-15 (pages 1-5)
Allow about 25 minutes for this section

Instructions

- Answer on the multiple choice answer sheet provided.
- Use pencil for questions 1-15

SECTION I

15 marks
Use the multiple-choice answer sheet for Questions 1-15.

---

1 If $\tan\theta = 0.75$ what is the value of θ to the nearest minute?

(A) 0.013'

(B) 36°52'

(C) 38°35'

(D) 63°35'

2 What is $\dfrac{4.85\times10^{4}}{1.24\times10^{-8}}$ in scientific notation, correct to three significant figures?

(A) 3.87×10^{4}

(B) 3.8×10^{12}

(C) 3.91×10^{12}

(D) 4×10^{12}

3 The height, h metres, of a toy hot air balloon after t seconds is modelled by the equation $h = -2t^2 + 10t$.

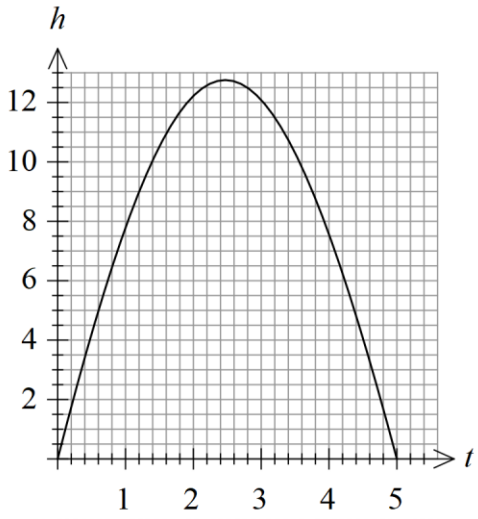
Reading from the graph, at what time(s) is the height of the balloon *approximately* 10m?

(A) 1.4 s

(B) 1.4s and -3.6s

(C) 3.6 s

(D) 1.4 s and 3.6 s



4 Kate bought a new laptop for $1700. This included 10 % GST. She left Australia on holiday and claimed a GST refund.

How much was the refund?

(A) $154.55

(B) $170.00

(C) $1530.00

(D) $1545.45

5 Ninety tagged fish were released into a lake, as part of an attempt to estimate the total number of fish in the lake. Two months later forty fish were caught, of which ten were tagged.

Which of the following is the best estimate of the fish population of the lake?

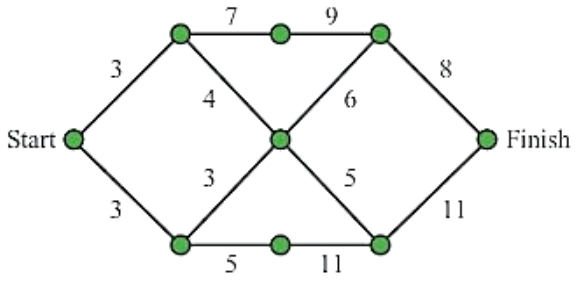
(A) 10

(B) 102

(C) 156

(D) 360

6 The following network shows the layout of a maze. Distances are in metres.



What is the shortest path from the start of the maze to the finish?

(A) 20 m

(B) 21 m

(C) 22 m

(D) 27 m

7 How much simple interest would be earned if \$12 167 was invested for 5 years at 2.5% p.a.?

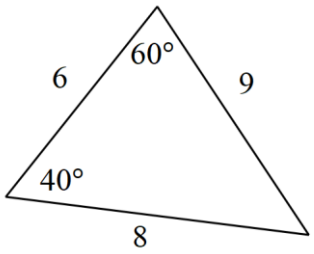
(A) \$152.09

(B) \$1220.87

(C) \$1521.00

(D) \$1520.88

8 Referring to the diagram below, which mathematical statement is correct?



NOT TO SCALE

(A) $9^2 = 8^2 + 6^2 + 2(8)(6)\cos 40°$

(B) $\dfrac{8}{\sin 60°} = \dfrac{6}{\sin 80°}$

(C) $6^2 = 9^2 + 8^2 - 2(8)(6)\cos 80°$

(D) $\dfrac{9}{\sin 40°} = \dfrac{8}{\sin 80°}$

9 A lift travels 298 metres in 42 seconds.

What is its average speed to the nearest kilometre per hour?

(A) 2 km/h

(B) 7 km/h

(C) 26 km/h

(D) 118 km/h

10 The correlation coefficient between the age and state of health of a certain population was found to be -0.3.

What best describes the expected strength and direction of this relationship?

(A) Strong positive correlation

(B) Strong negative correlation

(C) Zero correlation

(D) Weak negative correlation

11 The surface area of a cube is 96 cm^2.

What is the volume of the cube?

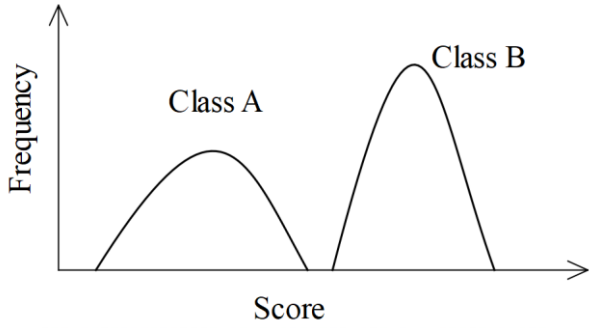
(A) 18 cm^3

(B) 48 cm^3

(C) 64 cm^3

(D) 96 cm^3

12 The graph shows the results of two class tests, both of which are normally distributed.



Which of the following statements is true?

(A) Class A has smaller mean but higher standard deviation than class B

(B) Class A has a higher mean and a smaller standard deviation than class B

(C) Class A has a smaller mean and smaller standard deviation than class B

(D) Class A has a higher mean and higher standard deviation than class B

13 A deck of cards consists of 5 red and 5 black cards. Two cards are selected at random without replacement.

What is the probability of choosing cards that are the same colour?

(A) $\frac{1}{50}$

(B) $\frac{2}{9}$

(C) $\frac{4}{9}$

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

14 Which equation represents a decreasing exponential function?

(A) $y = 3^{-x}$

(B) $y = 0.5(3^{x})$

(C) $y = 3(5^{x})$

(D) $y = (0.5)^{-x}$

15 Carlyn made two errors in her solution to the following equation:

$$4(1-x)-3(2+x)=20$$
$$4-4x-6+3x=20 \text{ ..... Line 1}$$
$$-2-x=20 \text{ ..... Line 2}$$
$$-x=18 \text{ ..... Line 3}$$
$$x=-18 \text{ ..... Line 4}$$

Which two lines do not follow correctly from the previous line?

(A) Line 1 and Line 2

(B) Line 1 and Line 3

(C) Line 2 and Line 4

(D) Line 3 and Line 4

End of Section I

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Name:……..…..

Teacher's Name:……

Pymble Ladies' College

HIGHER SCHOOL CERTIFICATE
TRIAL EXAMINATION
2020

Mathematics Standard 2

Section II

Answer Booklet

85 marks
Attempt Questions 16 – 44 (pages 9 – 28)
Allow about 2 hours and 5 minutes for this section

Instructions

- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of your response.
- Write using black or blue pen. Black is preferred.
- Erasable pens are **not** to be used.
- Your responses should include 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.

STAFF USE ONLY

	Sub Total	**Teacher's Initials**
Pages 9-11	/17	
Pages 12-16	/16	
Pages 17-20	/19	
Pages 21-24	/17	
Pages 25-28	/16	
Total Section II	/85	

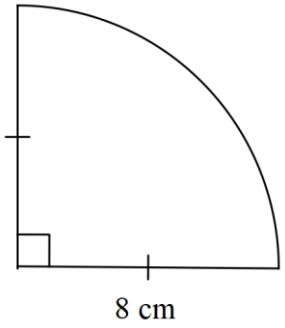
SECTION II

85 marks
Attempt all questions

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 **Marks**

Given the circumference of a circle is $C = 2\pi r$, calculate the perimeter of this shape, correct to two decimal places. **2**



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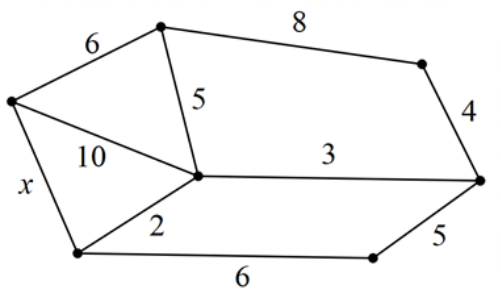
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Question 17 **Marks**

The length of the minimal spanning tree for the network below is 24.



If one of the edges in the minimal spanning tree is labelled as x, find the weight of the edge labelled x. **1**

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Question 18 **Marks**

A garden fertiliser is to be spread at a rate of 8 kilograms per 100 square metres of garden.

(a) How much fertiliser, to the nearest kilogram, is needed for a circular garden which has a radius of 15 metres? **2**

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(b) How many 40 kilogram bags of fertiliser, need to be purchased for the above mentioned garden to be treated three times? **2**

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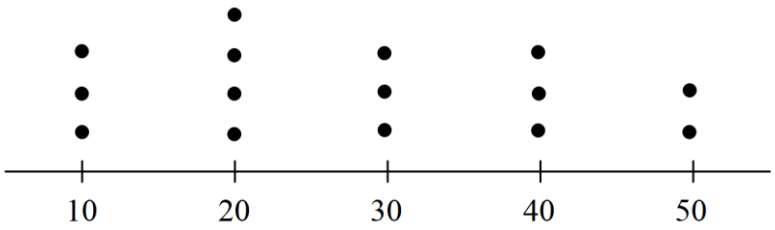
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Question 19 **Marks**

The dot plot shows the number of text messages sent by a group of 15 Year 12 students.



(a) Find the median number of text messages sent. **1**

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(b) Find the mean number of text messages sent. **1**

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(c) Find the standard deviation for the number of messages sent. **1**
Give your answer correct to two decimal places.

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Question 20 **Marks**

In a society, the probability that a female is born is given as 0.62.

(a) What is the probability that a male is born? **1**

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(b) What is the expected number of males in 1350 births? **1**

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Question 21 **Marks**

Calculate the total dividend on 1800 shares with a market price of 60 cents, if the dividend yield is 14%. **2**

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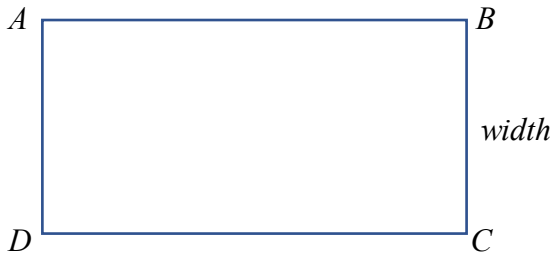
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Question 22 **Marks**

The perimeter of the rectangle $ABCD$ is $48cm$ where the length is three times the width.



(a) Show that the dimensions of the rectangle are $18cm$ x $6cm$. **2**

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(b) What angle, to the nearest degree, does the diagonal DB make with the side DC? **1**

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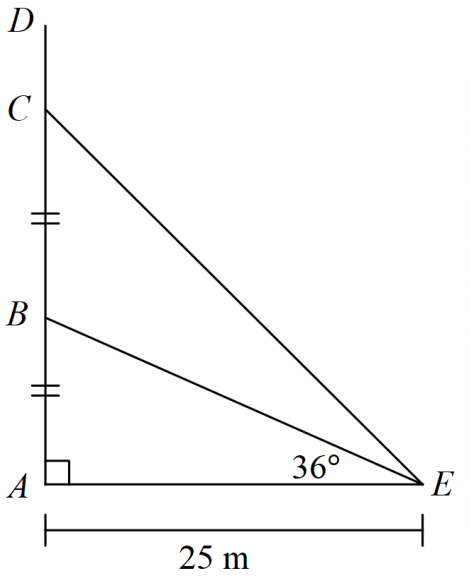
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Question 23 **Marks**

The diagram shows a radio mast AD with two of its supporting wires, BE and CE. The point B is half-way between A and C. **2**

Calculate the distance CE in metres, correct to one decimal place.



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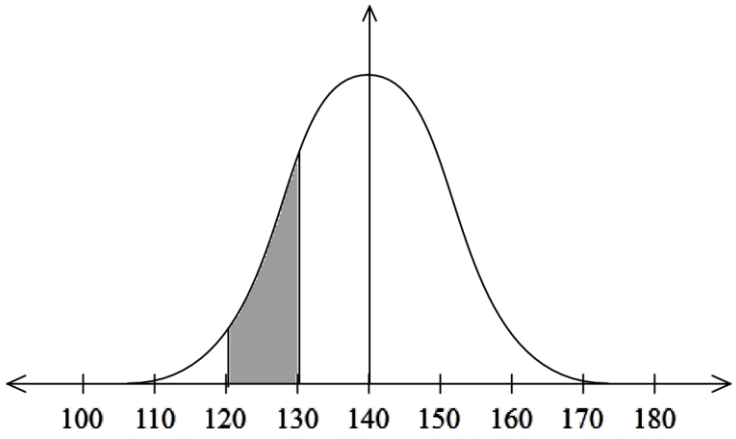
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Question 24 **Marks**

The normal distribution curve shown below has a mean of 140 and standard deviation of 10.



(a) Jasmine has a raw score in the shaded area. What value could her z-score be? **1**

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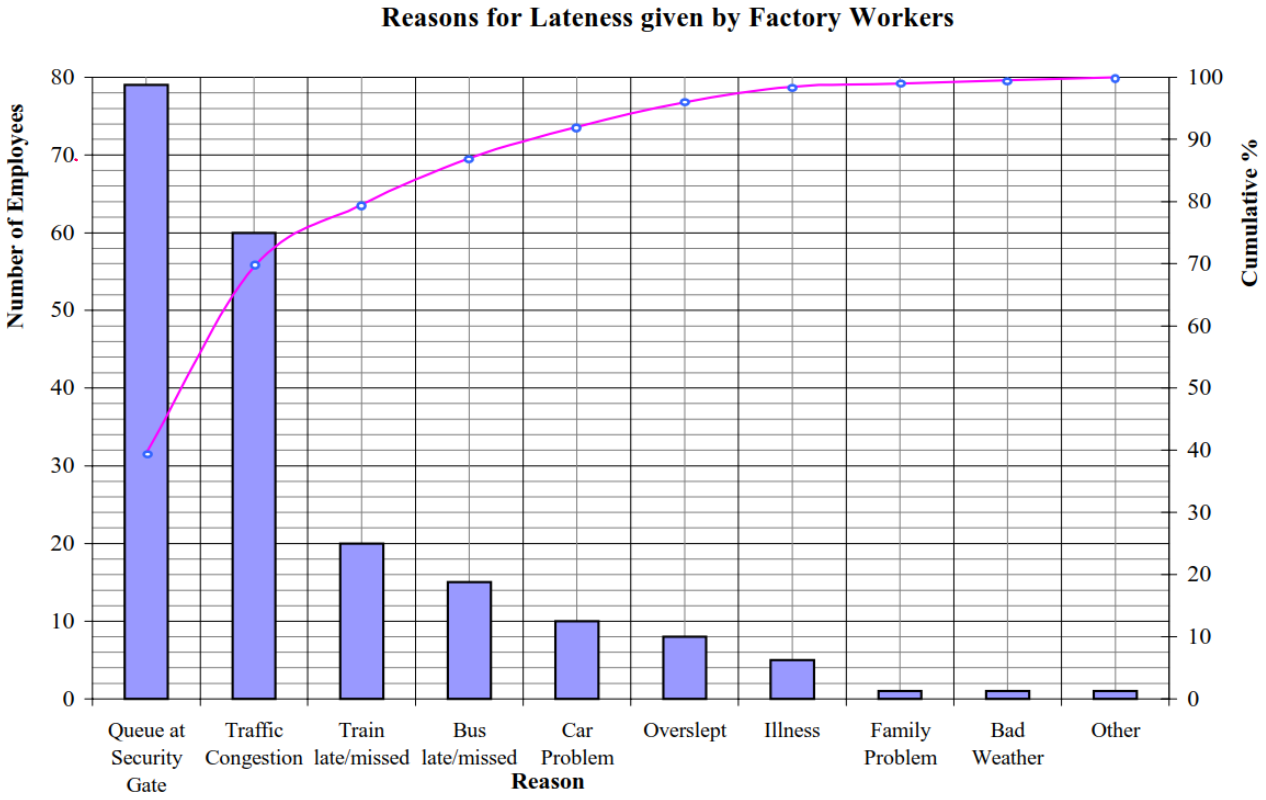
(b) What percentage of data lies in the shaded region? **1**

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Question 25 **Marks**

Lisa, the manager at a factory, was asked to determine the key reasons for lateness over the period of one month. She prepared this Pareto chart.



(a) How many workers stated "bus late/missed" during this month? **1**

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(b) Which two categories accounted for over 50% of the reasons for lateness? **1**

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Question 26 **Marks**

A 200 mL measuring cup is graduated in 1 mL divisions.

(a) What is the absolute error for this measurement? **1**

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(b) Suppose 50 mL is measured using this cup. Calculate the percentage error. **1**

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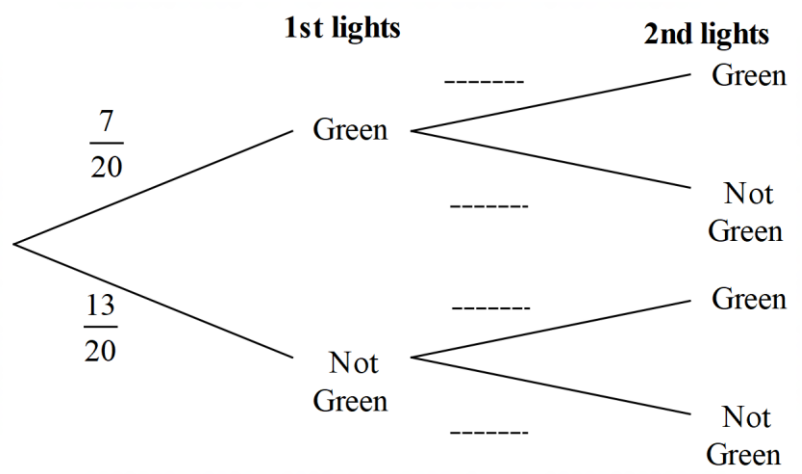
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Question 27 **Marks**

Along a section of highway there are two sets of traffic lights. The probability of catching a green light is $\frac{7}{20}$.

(a) Complete the tree diagram below by including all probabilities along branches. List all outcomes. **2**

Outcomes



(b) Calculate the probability of catching two green lights. **1**

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(c) What is the probability that at least one light is not green? **1**

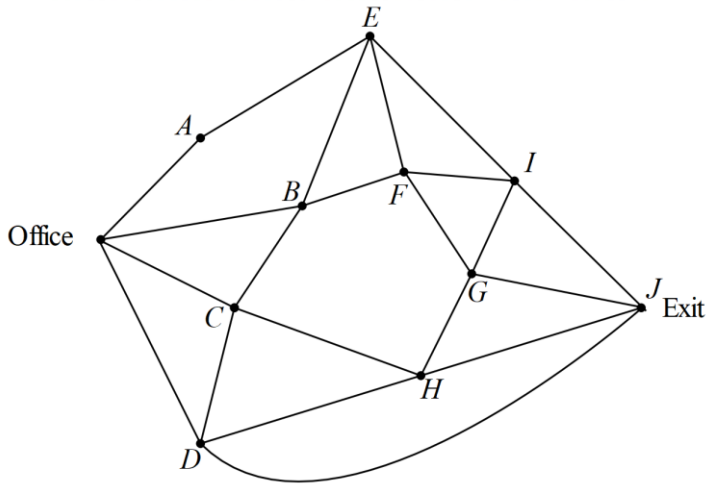
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Question 28 **Marks**

A large camping ground complex is represented by the network diagram below.
The nodes on the diagram, *A* to *J*, represent amenities blocks and the edges are roads connecting these blocks.



The manager of the camping ground likes to inspect all the roads in the complex each day.

(a) *Based on information contained in the graph*, explain why it is possible for the manager to travel over all the roads, starting and ending at the Office, without travelling along any of the roads more than once. **1**

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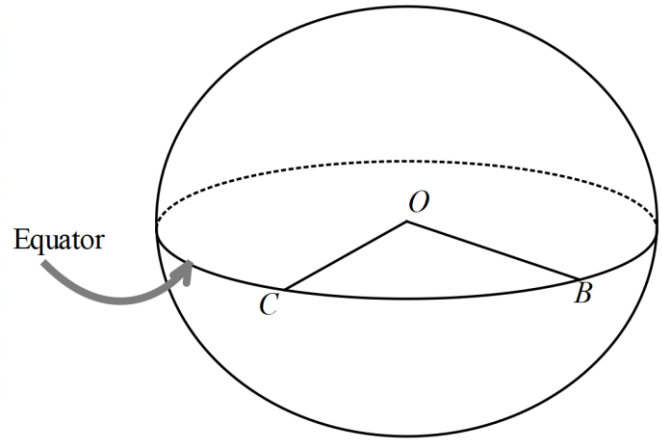
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(b) What is the route the manager could take? **1**

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Question 29 **Marks**

The diagram below represents the surface of the earth, where B and C represent coordinates.
The coordinates of B are $0°55°E$ and the coordinates of C are $0°42°W$.



(a) If O is the centre of the earth, find $\angle COB$. **1**

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(b) If the location of D is $15°$ north and $132°$ west of B, what are the coordinates of D? **1**

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Question 30 **Marks**

A car is travelling at 80 km/h in wet, slippery conditions.

(a) Given the driver's reaction time of 2.5 s, find the reaction distance to the nearest metre. **2**

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(b) The formula for braking distance is given as $d = 0.014v^2$ where **2**

d is the braking distance in metres
v is the speed of the car in km/h

Find the total stopping distance for the car travelling at 80 km/h.
Answer correctly to the nearest metre.

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Question 31 **Marks**

Olivia uses her credit card to make purchases of $450. Her credit card has no interest-free period and an interest rate of 14.6% p.a. compounded daily.

(a) Find the daily rate of interest. **1**

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(b) How much does Olivia need to pay to completely pay off her credit card account after 29 days? **1**

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Question 32 **Marks**

The table below shows the earliest start times (EST), latest start times (LST) and duration (in minutes) for each activity given.

Activity	Duration	Immediate Predecessor
A	10	-
B	15	A
C	12	A
D	18	A
E	35	B
F	8	C
G	10	B, F, D
H	15	E, G

(a) Draw a network diagram using the above table. Include EST and LST on your diagram. **3**

(b) What is the critical path for this network? **1**

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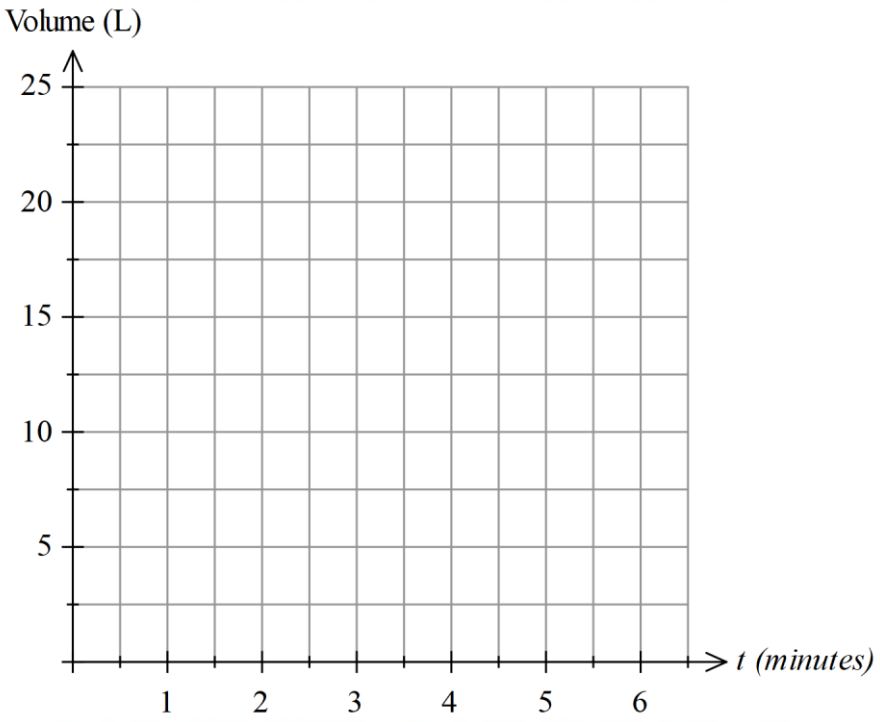
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Question 33 **Marks**

A cylindrical can full of water is leaking at a constant rate. The table below shows the volume of water in the cylindrical can after t minutes.

Time (minutes)	0	1	2	3	4
Volume (litres)	20	15	10	5	0

(a) On the axes below draw the graph connecting time and volume. **1**



(b) The equation which represents the volume (V) of water in the cylindrical can after t minutes, is of the form $V = c - dt$.

(i) What is the value of c? Give an explanation of its meaning. **2**

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(ii) Find the amount of water in the can after 90 seconds. **1**

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Question 34 **Marks**

Sara's annual income as a trainee engineer is $53 000. She also earns $4200 a year as a part-time consultant. Her allowable tax deductions total $2600 for the 2019 – 2020 financial year.
The table below shows the Income Tax rates for the given financial year.

Income tax rates for Australian residents	
Taxable income	**Tax on this income**
0 – $18 200	Nil
$18 201 – $37 000	19c for each $1 over $18 200
$37 001 – $87 000	$3572 plus 32.5c for each $1 over $37 000
$87 001 – $180 000	$19 822 plus 37c for each $1 over $87 000
$180 001 and over	$54 232 plus 45c for each $1 over $180 000

The Medicare levy is calculated as 2% of taxable income.

(a) Find Sara's taxable income for the 2019 – 2020 financial year. **1**

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(b) Calculate Sara's total tax payable, including the Medicare levy. **2**

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Question 35 **Marks**

The cost per passenger of hiring a bus is inversely proportional to the number of people on the bus. If there are 20 passengers, the cost per person is $14. **2**
What is the cost per passenger when there are fifteen passengers on the bus?
Give your answer to the nearest whole dollar.

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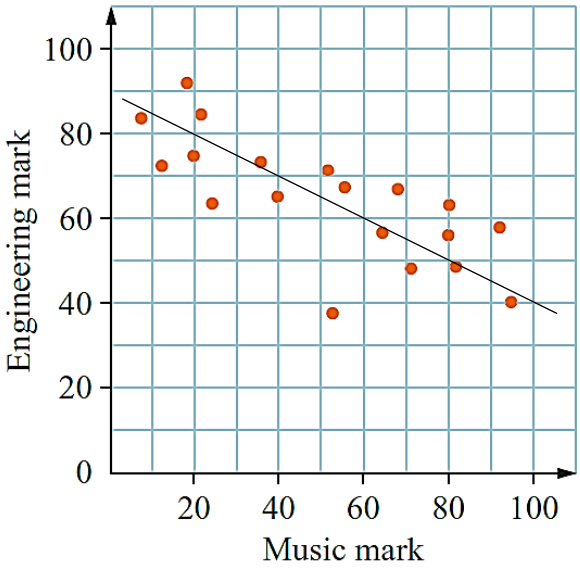
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Question 36 **Marks**

A teacher has prepared a scatterplot of the exam results for students studying Music and Engineering subjects. She included a line of best fit, as shown on the graph below.

Course Results



(a) How many students scored above 60 marks in both exams? **1**

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(b) A student commented, "Everyone who did well in Music also did well in the Engineering exam." Circle an example in the above graph, to show that this comment was *incorrect*. **1**

(c) Annie received a mark of 70 in her Music exam but was away for the Engineering exam. Using the line of best fit, find an estimate for Annie's mark in the Engineering exam. **1**

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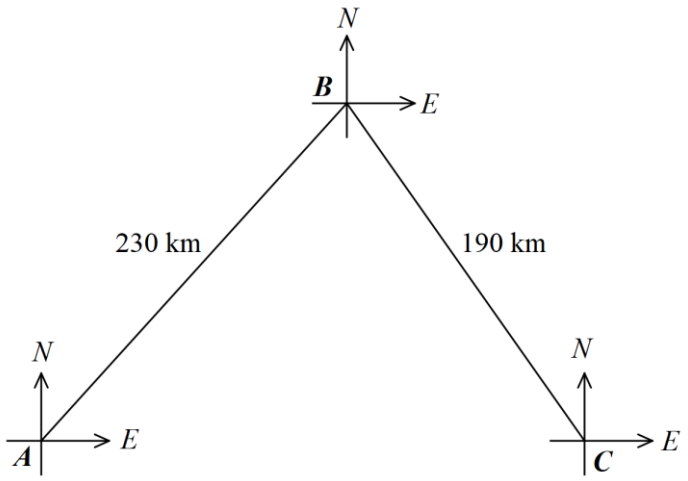
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Question 37 **Marks**

The bearing of a town B from town A is 037°T.

The bearing of a town B from town C is 345°T.

The distance AB is 230 km and the distance CB is 190 km. C is due East of A.



(a) Show that the size of $\angle ABC$ is 52°. **1**

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(b) Show that the size of $\angle ACB$ is 75°. **1**

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(c) Find the distance AC, to the nearest 10 km. **2**

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(d) Find the area of triangle ABC, to the nearest km. **1**

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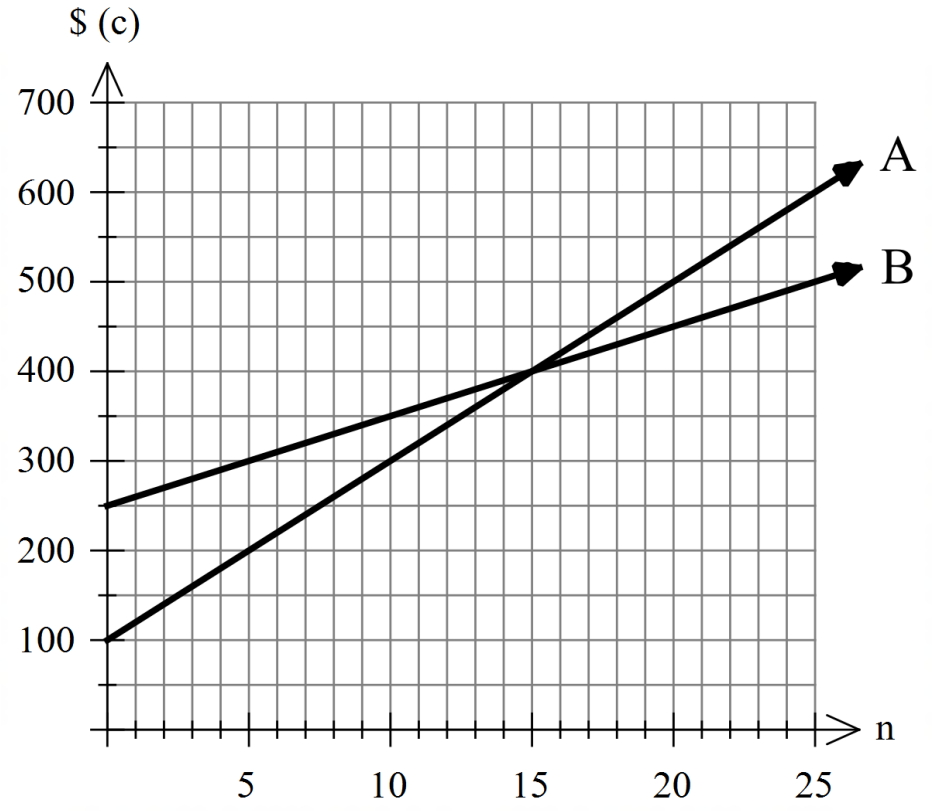
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Question 38 **Marks**

The graph shows the cost charged by two different businesses to cater for a party.
In each case the total cost (\$c) depends on the number of people attending (n).



(a) For what number of people attending do the two businesses charge the same amount? **1**

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(b) If ten people are to attend the party, which catering business would you recommend? Give a reason for your answer. **1**

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(c) If 25 people are to attend the party, what is the difference in the cost per person between the two businesses? **2**

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Question 39 **Marks**

Office printing equipment depreciates in value from $68 000 to $31 000 in 3 years. **3**
Use the declining balance formula to calculate the annual percentage rate of depreciation, to the nearest whole percentage.

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Question 40 **Marks**

The results of two class tests are normally distributed. The means and standard deviations of each test are displayed in the table below. **2**

	Test 1	Test 2
Mean	66	58
Standard Deviation	8	14

Anna scored 80 in both tests. She thinks that she performed better in Test 2.
Do you agree? Justify your answer using appropriate calculations.

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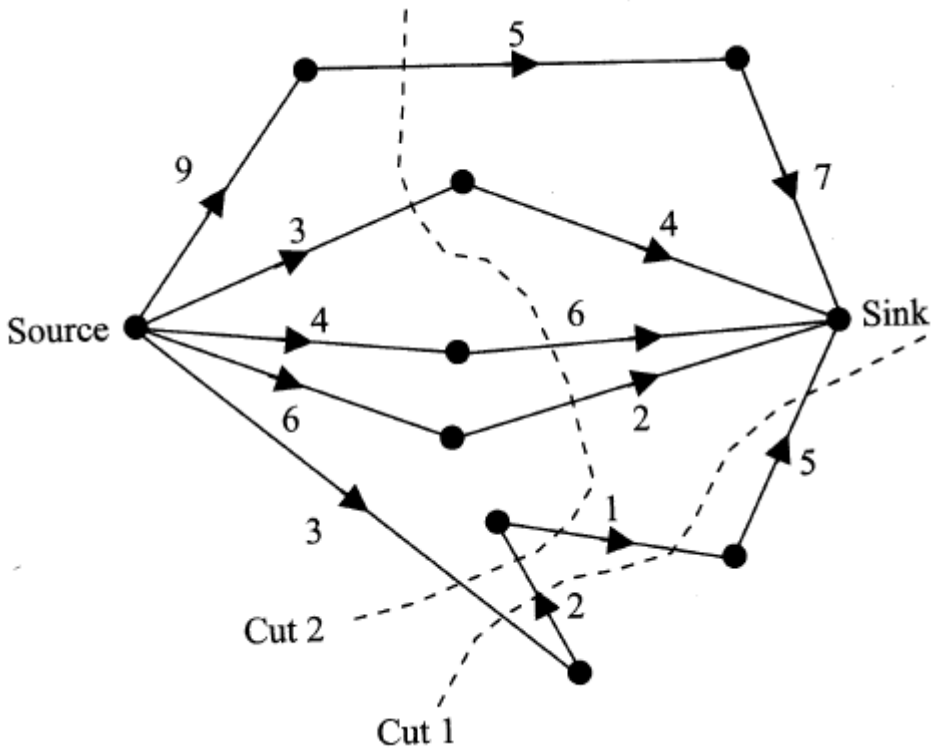
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Question 41 **Marks**



(a) Explain why Cut 1 on the above network, is not a valid cut for determining the maximum flow. **1**

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(b) Explain why the capacity of Cut 2 is **not** 22. **1**

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(c) Draw the minimum cut on the above network diagram and, hence, determine the maximum flow from source to sink. **2**

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Question 42 **Marks**

Lilli wants to borrow money to buy a house. The bank sent her an email with the following table attached.

Monthly repayments

Amount borrowed	*Term of loan*				
	10 years	15 years	20 years	25 years	30 years
	120 months	180 months	240 months	300 months	360 months
$80 000	$970.62	$764.52	$669.15	$617.45	$587.01
$90 000	$1091.95	$860.09	$752.80	$694.63	$660.39
$100 000	$1213.28	$955.65	$836.44	$771.82	$733.76
$110 000	$1334.60	$1051.22	$920.08	$849.00	$807.14
$120 000	$1455.93	$1146.78	$1003.73	$926.18	$880.52
$130 000	$1577.26	$1242.35	$1087.37	$1003.36	$953.89
$140 000	$1698.59	$1337.91	$1171.02	$1080.54	$1027.27
$150 000	$1819.91	$1433.48	$1254.66	$1157.72	$1100.65
$160 000	$1941.24	$1529.04	$1338.30	$1234.91	$1174.02

(a) Lilli calculates she can afford a maximum of $1000 per month on repayments. What is the maximum amount she can borrow, and how many years will she have to repay the loan? **1**

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(b) Lilli changes her budget and she instead decides to borrow $160 000 over 20 years from the same bank. Comparing the previous option with this new arrangement, how much interest can she expect to save over the full term of her loan? **3**

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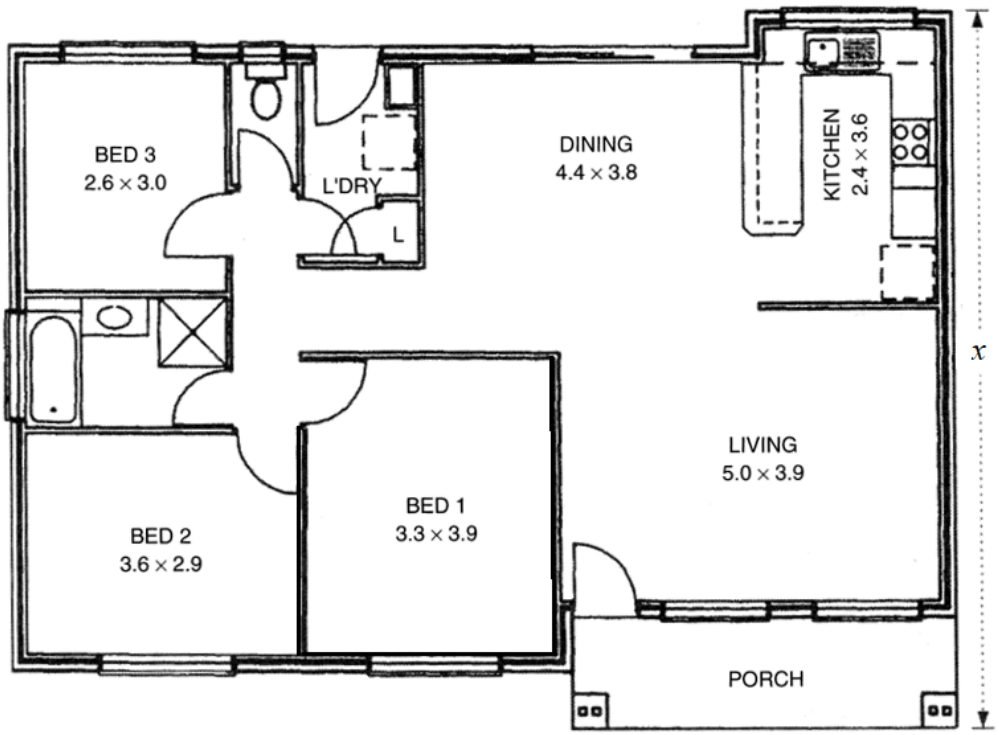
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Question 43 **Marks**

The drawing below shows the floor plan of a three-bedroom house with a porch, where measurements are displayed in metres.



(a) What scale is being used in the plan? **1**

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(b) Find the actual length of the building, from the front of the porch to the end of the kitchen (marked as x on the plan). **1**

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(c) The floor of Bedroom 1 is to be covered with square cork tiles. The tiles measure 30 cm × 30 cm. These tiles come in packs of 12, costing $ 30 per packet. **3**

How much will it cost to purchase tiles for this area?

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Question 44 **Marks**

Use the table below to answer the following questions.

Future value of $1 invested

Period	Interest rate per period									
	2%	2.50%	3%	3.50%	4%	4.50%	5%	5.50%	6%	8%
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0200	2.0250	2.0300	2.0350	2.0400	2.0450	2.0500	2.0550	2.0600	2.0800
3	3.0604	3.0756	3.0909	3.1062	3.1216	3.1370	3.1525	3.1680	3.1836	3.2464
4	4.1216	4.1525	4.1836	4.2149	4.2465	4.2782	4.3101	4.3423	4.3746	4.5061
5	5.2040	5.2563	5.3091	5.3625	5.4163	5.4707	5.5256	5.5811	5.6371	5.8666
6	6.3081	6.3877	6.4684	6.5502	6.6330	6.7169	6.8019	6.8881	6.9753	7.3359
7	7.4343	7.5474	7.6625	7.7794	7.8983	8.0192	8.1420	8.2669	8.3938	8.9228
8	8.5830	8.7361	8.8923	9.0517	9.2142	9.3800	9.5491	9.7216	9.8975	10.6366
9	9.7546	9.9545	10.1591	10.3685	10.5828	10.8021	11.0266	11.2563	11.4913	12.4876
10	10.9497	11.2034	11.4639	11.7314	12.0061	12.2882	12.5779	12.8754	13.1808	14.4866

(a) Find the contribution needed to be made at the end of each year, for 4 years, that will give a future value of $4500 if the annuity earns 8% compounded annually. **1**

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(b) Find the future value of an annuity (FV) with a contribution of $1500 per quarter for 21 months at 8% p.a. compounded quarterly. **2**

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End of Paper