Student Number

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2019
TRIAL
EXAMINATION

Manly Campus -
Northern Beaches Secondary College

Mathematics Standard 2

General Instructions	• Reading time – 10 minutes
	• Working time – 2 hours and 30 minutes
	• Write using black pen
	• NESA approved calculators may be used
	• A reference sheet is provided.
	• For questions in Section II, show relevant mathematical reasoning and/or calculations

Total Marks: **100**	**Section I – 15 marks** (pages 2 - 9)
	• Attempt Questions 1–15
	• Allow about 25 minutes for this section
	Section II – 85 marks (pages 12 - 32)
	• Attempt Questions 16–33
	• Allow about 2 hours 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.

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1   Aman purchased a laptop for $3,200 and depreciated it using the declining-balance method at 20% p.a.

How much is the laptop worth after 3 years?

    A $3,008.00

    B $3,011.81

    C $1,280.00

    D $1,638.40

2   Which of the following expresses the ratio 16:24 in simplest form?

    A   4:6

    B   8:12

    C   1:2

    D   2:3

3   What is the degree of vertex A in this network diagram?
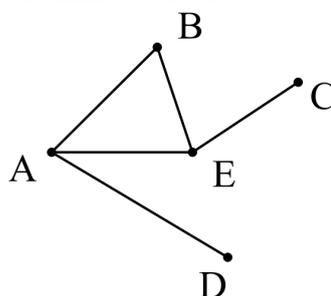
    A   4

    B   3

    C   2

    D   1

4 Which of the following graphs best represents the equation $y = \frac{2}{x}$?

A
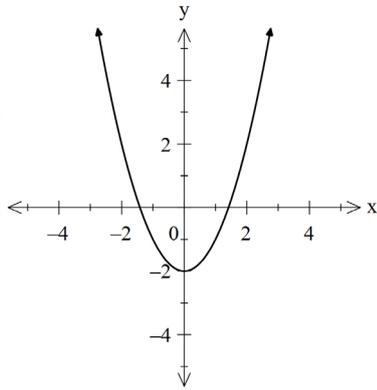
B
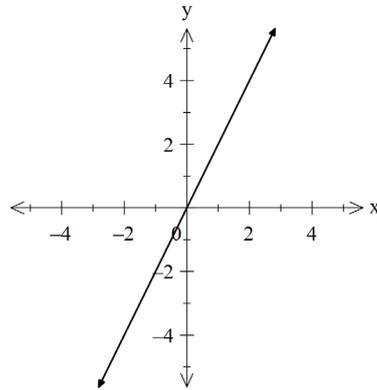
C
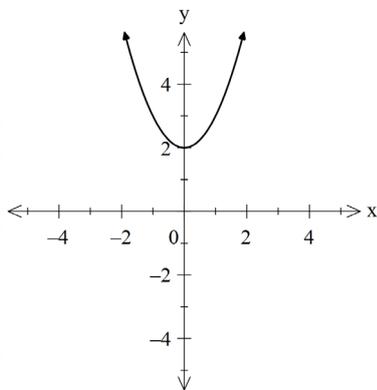
D
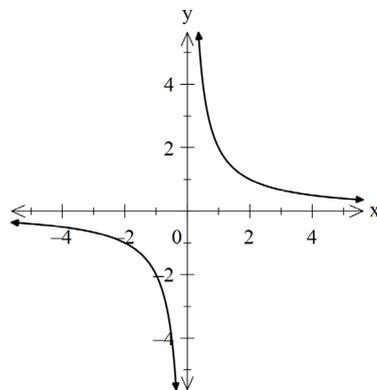
5 Which is the closest to the area of the triangle?

36.1 cm 35.4 cm 45.3 cm 50°
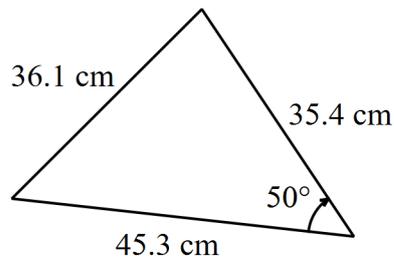
A 489.5 cm^2

B 614.2 cm^2

C 626.4 cm^2

D 515.4 cm^2

6 What is the equation of the line shown in the diagram?
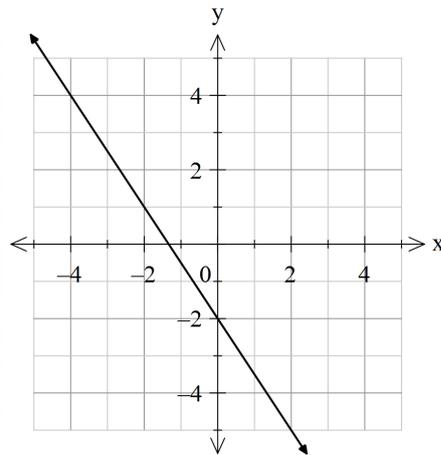
A $y = -\frac{3x}{2} - 2$

B $y = \frac{2x}{3} - 2$

C $y = \frac{3x}{2} - 2$

D $y = -\frac{3x}{2} + 2$

7 The variables *profit* and *amount spent on employee training* have a correlation coefficient of $r = 0.88$. Given this information, we can say that:

A Spending money to train employees reduces the profit.

B Increased profits are highly linked to increased training of employees.

C By spending money on training employees, a company has an 88% chance of increasing profits.

D Profits are increased by 88% by training employees

8   Cleo purchased a new set of furniture using a simple interest loan. The furniture cost $2300 and the interest rate on the loan is 12% p.a.

If she is to pay off the loan over 2 years, what will her monthly instalments be?

A $118.83

B $552.00

C $237.67

D $214.67

9   John is planning an overseas trip in 3 years. He wishes to save up $25,000 for his trip by investing in an annuity. He has chosen an account that pays 4% p.a., compounded quarterly.

	Future values of annuity of $1				
	Interest Rate				
Period	1%	2%	3%	4%	8%
3	3.0301	3.0604	3.0909	3.1216	3.2464
6	6.1520	6.3081	6.4684	6.6330	7.3359
9	9.3685	9.7546	10.1591	10.5828	12.4876
12	12.6825	13.4121	14.1920	15.0258	18.9771
18	19.6147	21.4123	23.4144	25.6454	37.4502
24	26.9735	30.4219	34.4265	39.0826	66.7648
30	34.7849	40.5681	47.5754	56.0849	113.2832
36	43.0769	51.9944	63.2759	77.5983	187.1021

Use the table of future values of an annuity of $1 above to find the amount that he needs to invest each quarter to achieve his goal.

A $1971.22

B $1663.80

C $8008.71

D $8250.55

10   This network diagram shows the streets connecting 5 suburbs.
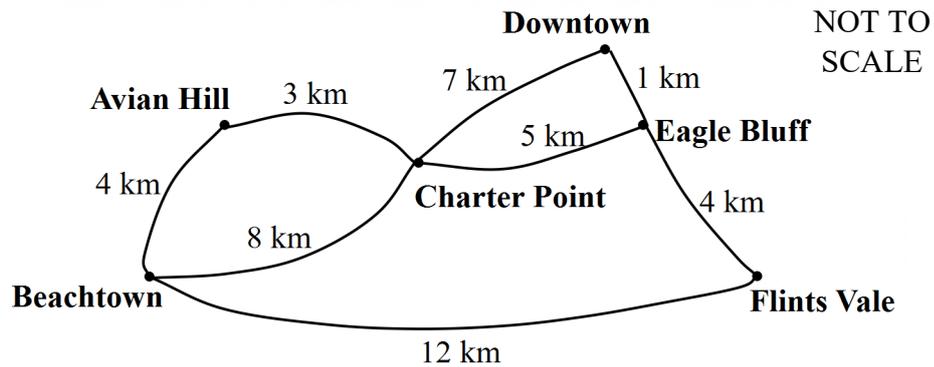
What is the shortest possible route to get from Beachtown to Downtown?

A   13 km

B   14 km

C   15 km

D   16 km

11   Matthias' car consumes an average of 11 litres of fuel per 100 kilometres for city driving, and 8 litres per 100 kilometres for country driving.

If Matthias takes a trip where he travels 62 kilometres in the city and 230 kilometres in the country, what is his expected fuel consumption?

A   28.66 L

B   25.22 L

C   32.16 L

D   27.74 L

12 Consider the data on the following scatterplot.
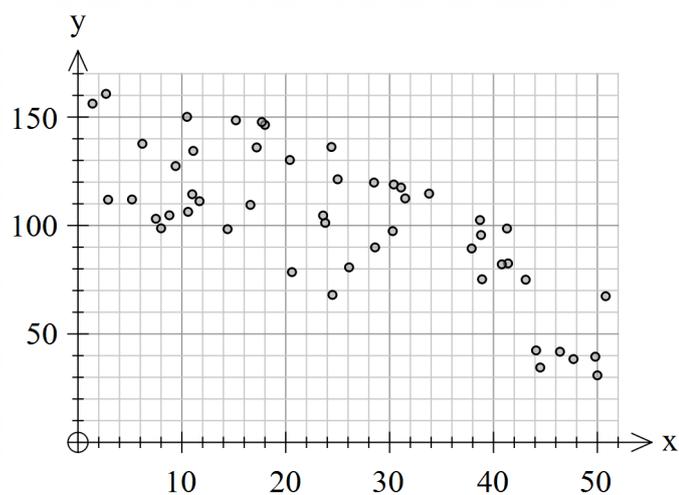
Which of the following would be the most reasonable choice for the line of best fit?

A $y = 145 - 1.7x$

B $y = 150 - 3.8x$

C $y = 100 + 1.7x$

D $y = 155 + 3.8x$

13 From a watchtower that is 50 metres tall, a guard spots suspicious activity near a vehicle that is at an angle of depression of 35° from the tower.

Which of the following expressions would be a way for the guard to calculate the distance of the car from the base of the tower?

A $\dfrac{50}{\tan(35°)}$

B $50 \times \tan(35°)$

C $\dfrac{\tan(35°)}{50}$

D $\dfrac{50}{\tan(55°)}$

14 The following shows the graph of $y = a^x$, for some number a that is greater than 1.
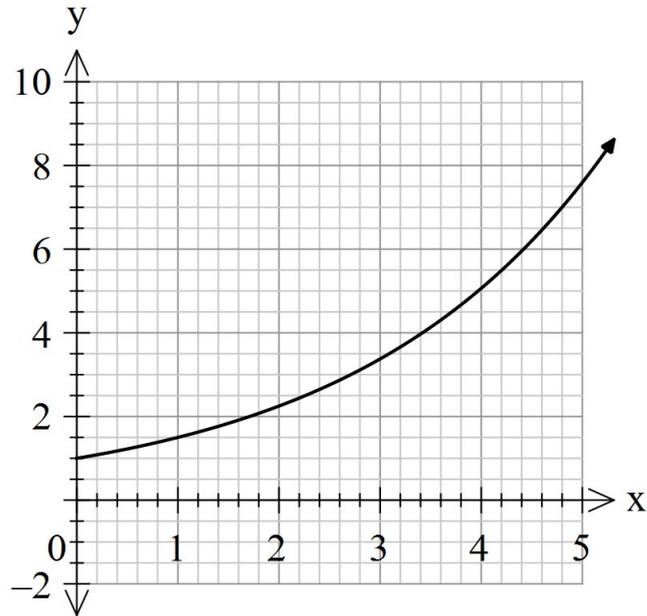
Which would be the closest to the value of $0.5(a^{4.2})$?

A   6

B   5.5

C   3

D   2.75

15 The following network diagram shows the capacities of roads from one particular suburb to the motorway entrance.
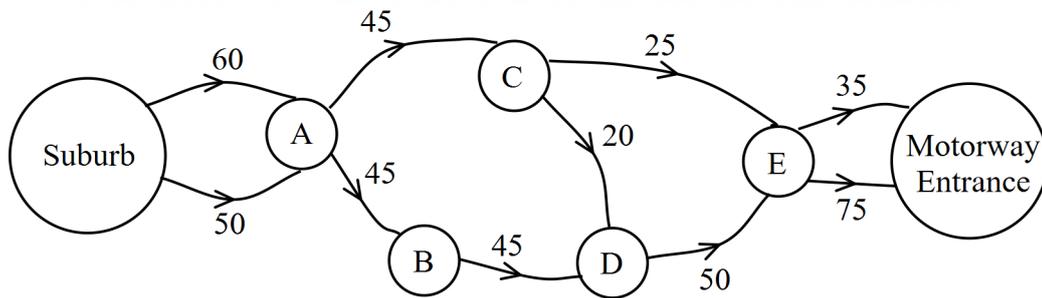
After complaints of traffic congestion, the local planning committee is considering ways to maximise the network capacity.

Which of the following proposals would achieve this goal?

A   Add a road from A to D with a capacity of 20.

B   Widen the road from D to E to increase its capacity by 15.

C   Add a road from B to C with a capacity of 20 and widen the road from C to E to increase its capacity by 20.

D   Add a road from A to D with a capacity of 20 and widen the road from D to E to increase its capacity by 35.

End of Multiple Choice

2019

Manly Campus -
Northern Beaches Secondary College

Mathematics Standard 2

Section II Answer Booklet

85 marks
Attempt Questions -
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 response.

- 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.

Question 16 (2 marks)

Pedro invests $5,000 into an account earning interest at 3.5% p.a., compounded monthly.

If he leaves the money in the account for 2 years, how much interest will he earn, to the nearest cent?

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Question 17 (2 marks)

A recipe for making large batches of chocolate chip cookies requires flour and sugar in the ratio of 3:2.

If the recipe claims 2 cups of flour will make 25 cookies, how much sugar is needed to make 60 cookies?

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Question 18 (2 marks)

The three angles in a triangle are $3x$, $5x + 60$, and $60 - 2x$. Find the size of each angle in the triangle.

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Question 19 (3 marks)

In the following triangle, θ is an obtuse angle. **3**
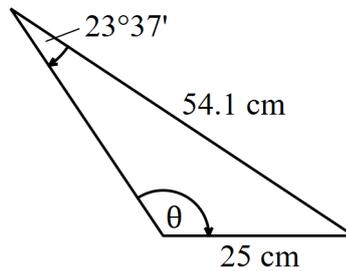
Find the value of θ to the nearest minute.

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Question 20 (6 marks)

Robert is curious about his favourite candy-coated chocolates Smart-M's. He reads on the label that they contain 520 kJ per 25 gram serving. Using a scale, he discovers that 35 Smart-M's weigh 25 grams.

(a) How many kilojoules are in each Smart-M? Round your answer to the nearest **1** whole kJ.

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Question 20 continues on page 14

Question 20 (continued)

(b) Robert uses the following formula he found online to calculate the number of kilocalories he burns from walking:

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$$C = 0.035W + \frac{V^2}{H} \times 0.029W$$

where C is kilocalories per minute, W is weight in kilograms, V is speed in metres per second, and H is height in metres.

If Robert weighs 100 kilograms, is 1.25 metres tall, and typically walks at a speed of 1.4 metres per second, use the formula and the fact that one calorie is approximately 4.2 joules to calculate the number of kilojoules he burns per minute from walking. Round your answer to the nearest whole kJ.

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(c) Given your calculations in parts (a) and (b), find how far Robert needs to walk in order to burn the kilojoules from one Smart-M, to the nearest metre.

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End of Question 20

Questions 16 -20 are worth 15 marks in total

Question 21 (6 marks)

A cobbler repairs the soles of old shoes for $45 per pair. It costs $13 for new soles for a pair of shoes and $2880 for the equipment needed to repair them.

The income, I, and cost, C, functions for repairing n pairs of shoes are illustrated in the following graph.
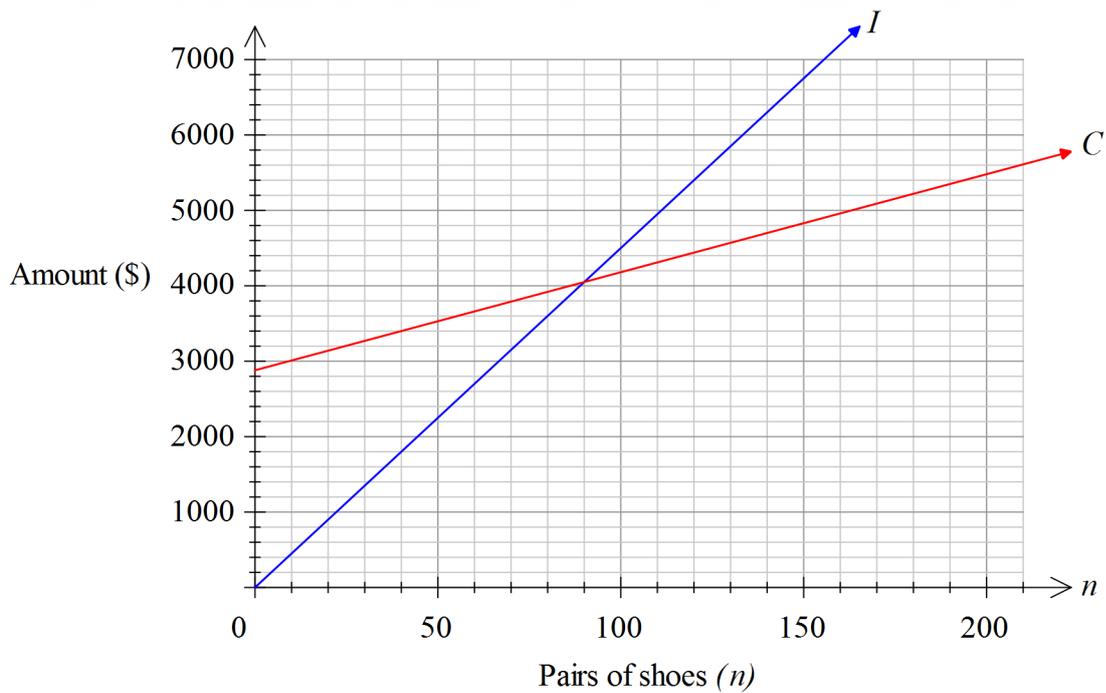
(a) Determine the equations of the cost, C, and income, I, functions for fixing n pairs of shoes. **2**

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Question 21 continues on page 16

Question 21 (continued)

(b)   Determine the break-even point and explain what it represents.   **2**

(c)   Write down a formula for the profit, *P*, made for fixing *n* pairs of shoes.   **1**

(d)   Find the profit when 200 pairs of shoes are fixed.   **1**

End of Question 21

Question 22 (7 marks)

The time it takes for an accounting department to balance the books varies inversely with the number of accountants working on the task. Last year, when 4 accountants worked on balancing the books, it took 20 hours to complete.

(a) Show that the relationship between t, the time to complete the task in hours, and n, the number of accountants working on the task, can be given by the equation $t = \dfrac{80}{n}$. **2**

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(b) How many hours would it take if twice as many accountants work on the task this year than last year. **1**

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(c) How many accountants would need to be on the task for it to be completed in 8 hours? **1**

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Question 22 (continued)

(d) Sketch a graph of the relationship between t and n on the axes below using at least three labelled coordinates. **3**
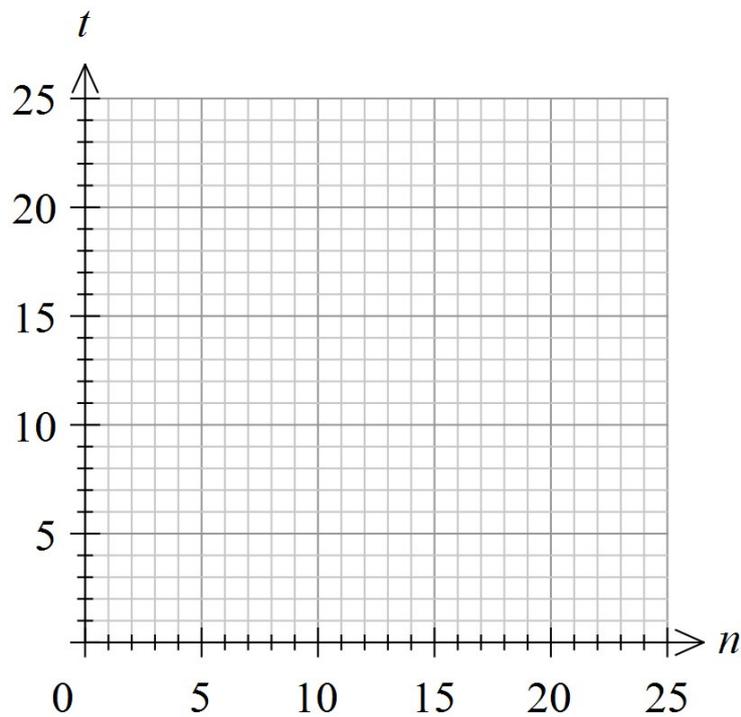
Question 23 (6 marks)

A university IT department has done a study to analyse the cost of installing a new high-speed fibre optic network on the campus, taking into account the distances and current infrastructure. The cost, in thousands of dollars, to connect cables between the main buildings is provided in the table below. (Buildings that cannot feasibly be connected are indicated by a "-" symbol.)

	A	B	C	D	E
A		10	-	12	7
B	10		4	11	12
C	-	4		6	-
D	12	11	6		9
E	7	12	-	9	

Question 23 continues on page 19

– 18 –

Question 23 (continued)

(a) Use the table above to complete the weighted network diagram below, representing the cost to connect the buildings in thousands of dollars. **2**
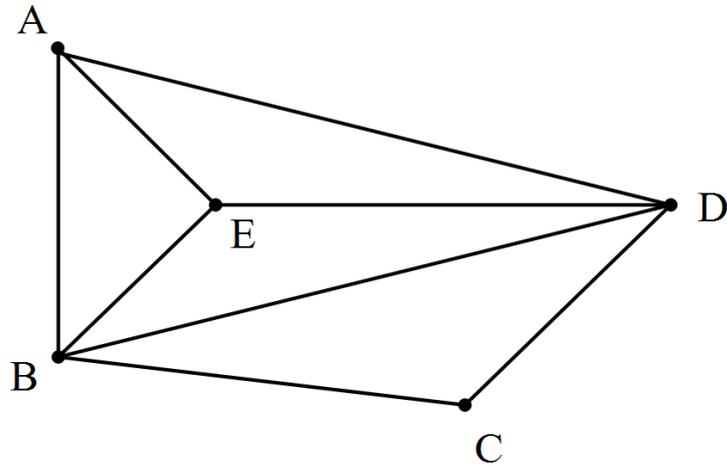
(b) Use your network diagram in part (a) to draw a minimum spanning tree for the campus in the space provided below. **2**

(c) What is the minimum cost (in dollars) to connect all the buildings on the campus with fibre optic cabling? **2**

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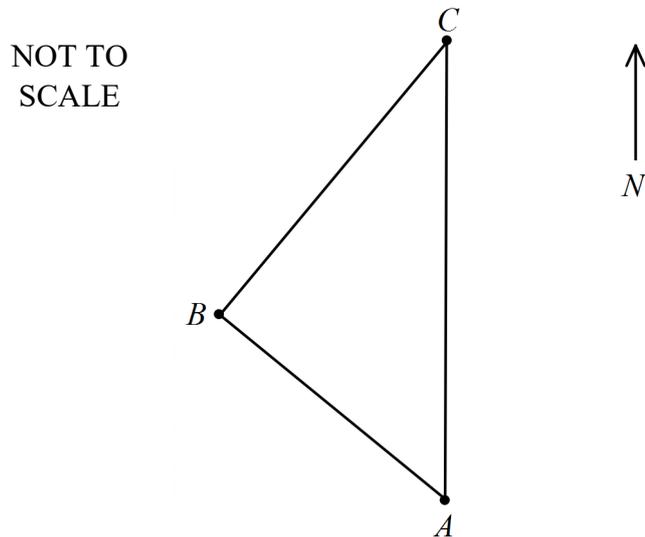
End of Question 23

Questions 16 -23 are worth 34 marks in total

Question 24 (6 marks)

The diagram below shows three towns, A, B, and C. A plane travelling from town A to town C must make a stop-over at town B. Town B is 120 km on a true bearing of 312° from town A. Town C, which is directly north of town A, is on a true bearing of 042° from town B.

(a) Mark the given information on the diagram and find the measure of $\angle ABC$. **3**

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(b) How much farther is the plane's trip with the stop-over at B than if it were to fly directly from A to C? Give your answer to the nearest kilometre. **3**

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End of Question 24

Question 25 (4 marks)

Wilfrid is charged 17.52% p.a. interest, compounded daily, on his credit card, with no interest-free period. Interest is charged from, and including, the date of purchase to, and including, the date of payment. He checks his balance on the 18th of June and finds an outstanding balance of $2344.52. On the 25th of June he makes a $210.00 purchase, and on the 8th of July he makes a purchase of $53.20.

How much will be owing on Wilfrid's credit card when he is due to make his next payment on the 15th of July?

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End of Question 25

Questions 16 -25 are worth 44 marks in total

Approximately half way through Section II
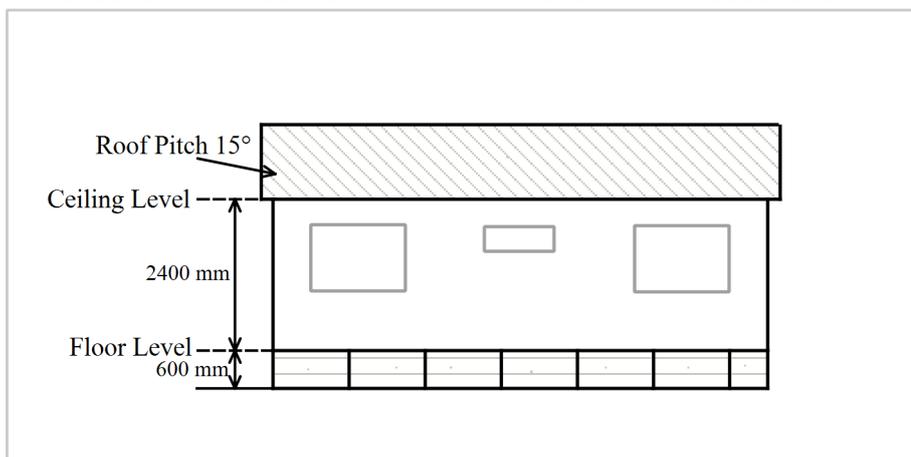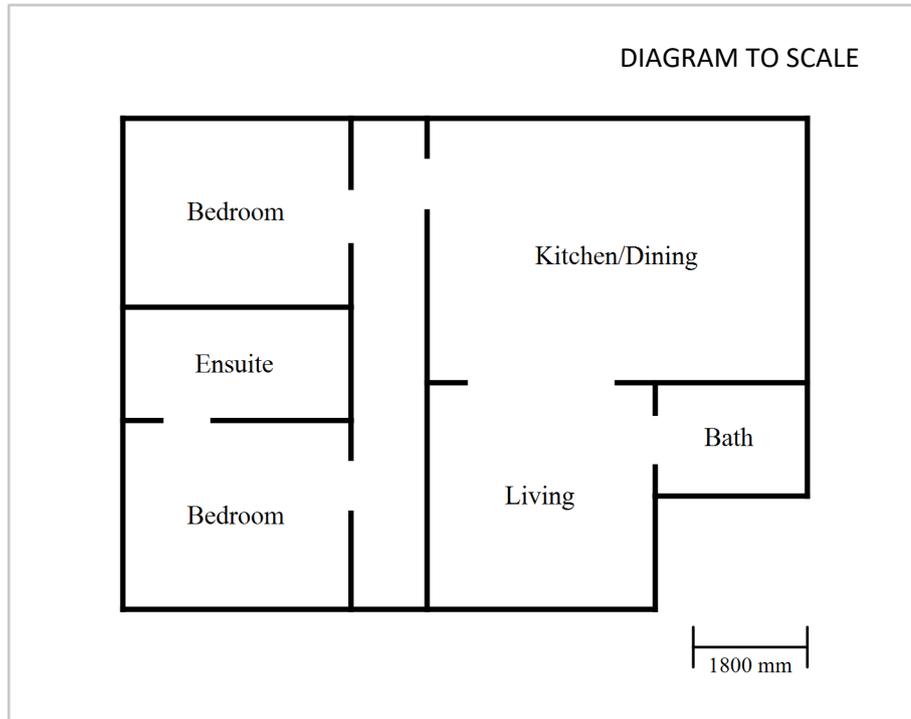
Question 26 (5 marks)

Tomyris has drawn the floor plan and elevation view below of a new home she intends to build on a block of land that she owns.

DIAGRAM TO SCALE

Bedroom

Kitchen/Dining

Ensuite

Bath

Living

Bedroom

1800 mm

Roof Pitch 15°

Ceiling Level

2400 mm

Floor Level

600 mm

(a) Use the scale given on the floor plan to calculate the total length (perimeter)   **2**
of the outer walls of the house. Give your answer in metres.

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Question 26 continues on page 23

Question 26 (continued)

(b) Tomyris plans on utilising a new government rebate to install insulation in the outer walls. The insulation costs $30 for every 8.2 square metres of wall area plus $900 for installation. The government will pay for 50% of the cost over $500.

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If 15.2 square metres of wall area will be occupied by windows and doors, how much will it cost Tomyris to insulate the outer walls if she receives the rebate?

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End of Question 26

Question 27 (6 marks)

The diagram below shows a survey of the land Tomyris will build her house on.
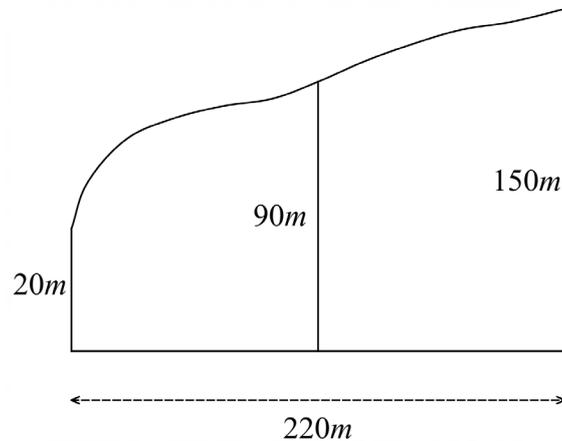
(a) Use two applications of the trapezoidal rule to estimate the area of the land to the nearest 100 square metres. **3**

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(b) Tomyris plans on grading the land so that it serves as the main catchment area for a pond at its lowest elevation. To maintain the water level in the pond, it is estimated that at least 10 megalitres of rain must flow into the pond each year. (1 ML = 1,000,000 L) **3**

If 40% of the rain that falls on the land flows into the pond, calculate the amount of rainfall, in millimetres, must fall on the land each year, to maintain the water level in the pond. Round your answer to the nearest 10 mm.

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End of Question 27

Question 28 (6 marks)
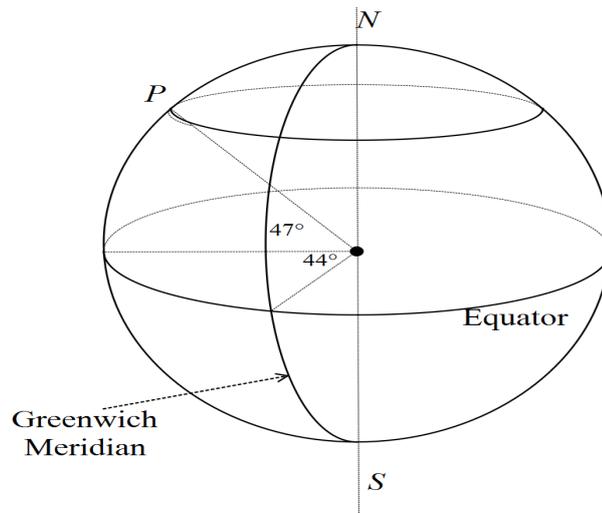
Point Q has the same longitude as P but is $60°$ further south.

Point R has the same latitude as P and has a longitude of $61°E$

Point P is in the time zone UTC+3

(a) Write down the coordinates of P and Q.   **2**

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(b) If point R is in the time zone UTC–4 what is the time difference between P and R?   **1**

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(c) Landing restrictions at R require that planes cannot land or take-off between 11pm and 6am. A flight from P to R is expected to take 10.5 hours. At what times of day does a plane need to leave from P to be allowed to land at R?   **3**

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Question 29 (3 marks)

Amanda randomly chooses two pieces of fruit from a bowl of fruit containing **3**
4 apples and 6 bananas.

Is Amanda more likely to choose two different pieces of fruit, or two of the
same pieces of fruit?

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End of Question 29

Questions 16 – 29 are worth 64 marks in total.

Question 30 (3 marks)

The diagram shows the results of a compass radial survey of a triangular area of land.
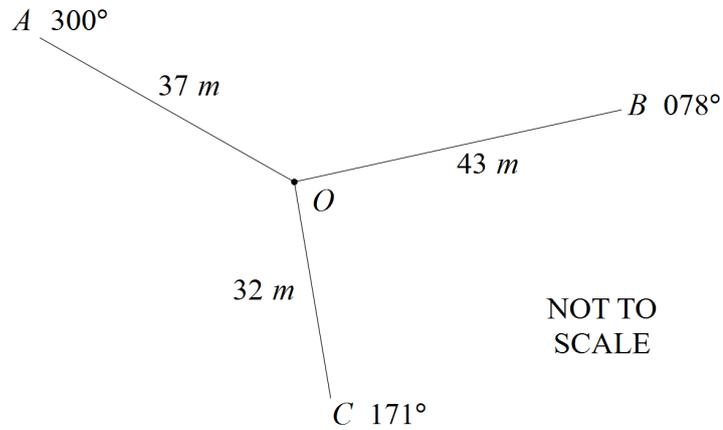
(i)   Find the size of angle *AOB*.   **1**

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(ii) Find the length of *AB* to the nearest metre.   **2**

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End of Question 30

Question 31 (5 marks)

This table is used to calculate income tax for individuals. **5**

Taxable income	Tax payable
$0 - $18 200	Nil
$18 201 - $37 000	Nil + 19 cents for each $1 over $18 200
$37 001 - $87 000	$3 572 + 32.5 cents for each $1 over $37 000
$87 001 - $180 000	$19 822 + 37 cents for each $1 over $87 000
$180 001 and above	$54 232 + 45 cents for each $1 over $180 000

Max has a gross annual salary of $78 900, a uniform allowance of $34.50 per fortnight and union fees of $11 per week. The Medicare levy to be paid is 2% of the taxable income.

Max has already paid $16 200 in tax.

Will Max receive a tax refund or have to pay additional tax?

Justify your answer with calculations to determine the amount of tax refund or tax payable.

Question 32 (7 marks)

Isabella needs to model the position of a projectile launched into the air on a hillside. She knows that the path of the projectile can be given by the equation $y = 2x - 0.25x^2$, where x represents the projectile's horizontal position in metres, and y represents the projectile's vertical position in metres. The projectile is to be launched from a horizontal and vertical position of 0.

She uses graphing software to produce the following graph of the path of the projectile.
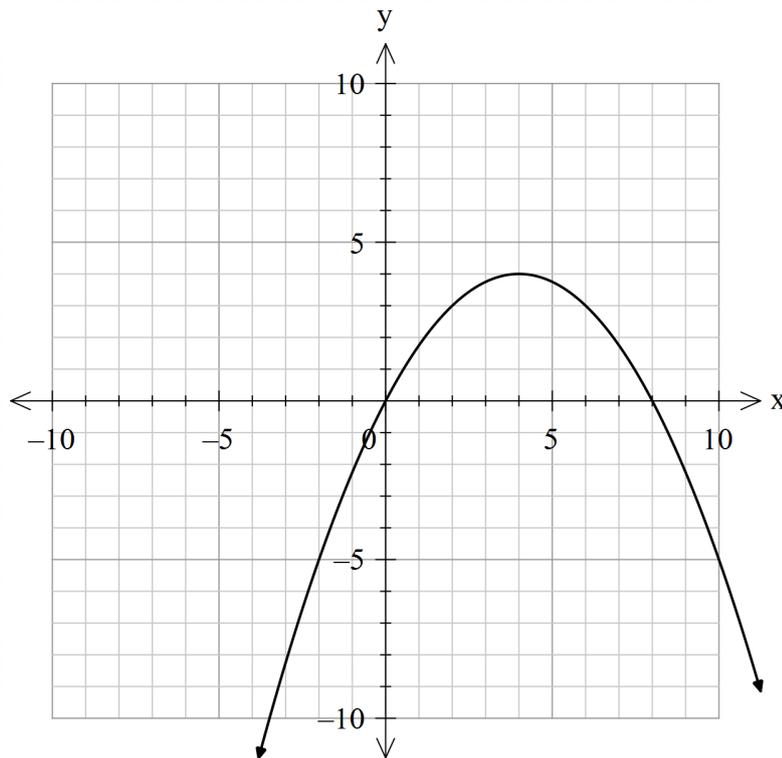
(a) Isabella has found that the hillside uniformly rises 1 metre for every 2 metres travelled horizontally in the direction the projectile is to be launched. Draw a line on the graph above to represent the hillside and write its equation below. **2**

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Question 32 (continued)

(b) Find the angle of elevation of the hill in degrees, to one decimal place.   **2**

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(c) Using the graph, or otherwise, find the distance along the hillside from the   **3**
launch position to the point where the projectile lands on the hillside, to the
nearest tenth of a metre.

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End of Question 32

Question 33 (6 marks)

A project requires activities A to G to be completed, as shown in the table below. **6**

Activity	Immediate Prerequisite(s)	Duration (hours)
A	-	10
B	-	?
C	-	9
D	A	8
E	B	?
F	C	?
G	C, D, E	?

The minimum completion time for the project is 30 hours, and the critical path includes activities A, D, and G. The float for activity E is 5 hours and the float for activity F is 10 hours.

Find a possible duration for each of the activities B, E, F, and G. Include a network diagram in your answer.

Question 33 (Additional Space)

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End of examination

Section I

Question	Solution	Answer
1	$S = V_0(1 - r)^n$ (see Reference Sheet) $S = 3200(1 - 0.20)^3 = \$1,638.40$	D
2	16:24 (divide both sides by 8) 2:3	D
3	There are 3 edges connected to vertex A, so its degree is 3.	B
4	$y = \frac{2}{x}$ is a hyperbola when graphed, giving the following shape: 	D
5	$A = \frac{1}{2}ab \sin C$ (see reference sheet) $A = \frac{1}{2} \times 45.3 \times 35.4 \times \sin 50° = 614.222 \dots \approx 614.2 \text{ cm}^2$	B
6	Gradient: $m = \frac{-3}{2}$ y-intercept: $b = -2$ $y = mx + b$ $y = -\frac{3}{2}x - 2$ or $y = -\frac{3x}{2} - 2$	A
7	r=0.88 is a strong positive correlation	B
8	$I = Prn$ $I = 2300 \times 0.12 \times 2 = \$552$ Total to pay back: $\$2,300 + \$552 = \$2,852$ Divide over 24 months: $2852 \div 24 = \$118.83$ (to nearest cent)	A
9	4% p. a.÷ 4 quarters = 1% per quarter 3 years × 4 quarters = 12 quarters $25000 = PV \times 12.6825$ $PV = 25000 \div 12.6825 = \$1971.22$	A
10	Possible routes from Beachtown to Downtown: BACD – 14 km BACED – 13 km ← shortest route BCD – 15km BCED – 14 km BFED – 17 km	A
11	City: 62 km $\times \frac{11 \text{ L}}{100 \text{ km}} = 6.82$ L Country: 230 km $\times \frac{8 \text{ L}}{100 \text{ km}} = 18.4$ L Total: 6.82 L + 18.4 L = 25.22 L	B
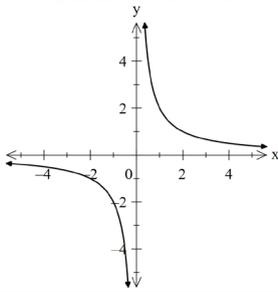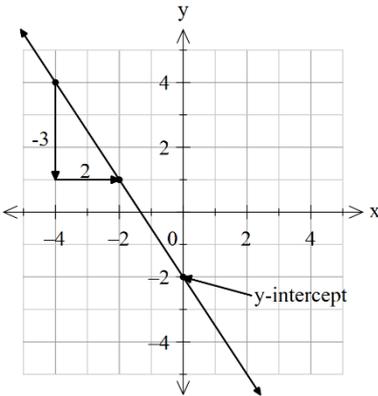
12	The line would start a little below 150 and have a negative gradient close to -1.5. The closest choice is $y = 145 - 1.7x$		A
13	$\tan(35°) = \dfrac{50}{x}$ $x = \dfrac{50}{\tan(35°)}$		A
14	When $x = 4.2$, $y = 5.5$ $0.5(5.5) = 2.75$		D
15	Vertex A has 110 flowing in, and only 90 flowing out. Vertex D has 65 flowing in, and only 50 flowing out. Adding a road from A to D with a capacity of 20 will balance the in and out flow at vertex A. Increasing the capacity of the road from D to E by 35 will balance the in and out flow at vertex D, including the newly added road from A.		D
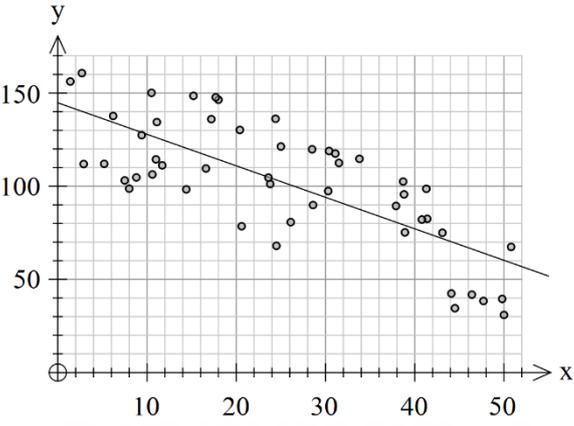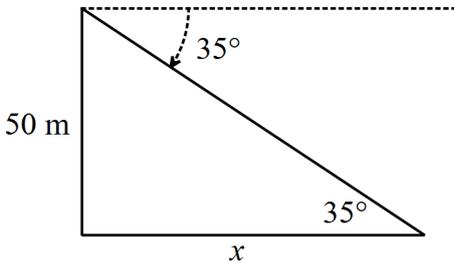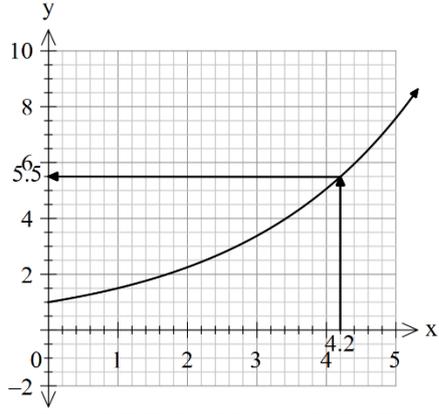
Section II

Question 16	
$FV = PV(1 + r)^n$ (see Reference Sheet) $PV = 5000, r = \frac{0.035}{12}, n = 2 \times 12 = 24$ $FV = 5000\left(1 + \frac{0.035}{12}\right)^{24} = \$5{,}361.99457 \approx \$5{,}361.99$ ✓ Interest = 361.99 ✓	2

Question 17	

Flour : Cookies
    2 : 25
    x : 60
$x = 60 \div 25 \times 2 = 4.8$ cups of flour
 	
Flour : Sugar
    3 : 2
   4.8 : y
$y = 4.8 \div 3 \times 2 = 3.2$ cups of sugar
	2

Question 18	
Sum of angles of a triangle is 180° $3x + 5x + 60 + 60 - 2x = 180$ (add like terms) $6x + 120 = 180$ (subtract 120 from both sides) $6x = 60$ (divide both sides by 6) $x = 10$ ✓ Angles: $3(10) = 30°, 5(10) + 60 = 110°, 60 - 2(10) = 40°$ ✓	2

Question 19	
$\frac{\sin(\theta)}{54.1} = \frac{\sin(23°37')}{25}$ (Sine rule, see Reference Sheet) ✓ $\sin(\theta) = \frac{54.1 \times \sin(23°37')}{25} = 0.8669\ldots$ $\theta = \sin^{-1}(0.8669\ldots) = 60.1040\ldots°$ ✓ Obtuse angle: $180° - 60.1040\ldots = 119.8959\ldots° \approx 119°54'$ (to the nearest minute) ✓	3

Question 20		
(a)	520 kJ $\div$ 35 $= 14.85 \ldots$ kJ $\approx$ 15 kJ per Smart-M	1
(b)	$C = 0.035(100) + \frac{1.4^2}{1.25} \times 0.029(100) = 8.0472$ kcal per minute ✓ $8.0472 \times 4.2 = 33.79824$ kJ $\approx$ 34 kJ per minute ✓	2
(c)	15 kJ $\div$ $34\frac{\text{kJ}}{\text{min}} = 0.4417\ldots$ min ✓ $0.4417\ldots \times 60 = 26.47\ldots$ sec ✓ $1.4\frac{\text{m}}{\text{s}} \times 26.47$ s $= 37.05\ldots$ m $\approx$ 37 m ✓ (an answer within 1 m may be obtained depending on rounding or use of exact values in calculations)	3

Question 21		
(a)	$C = 2880 + 13n$ ✓ $I = 45n$ ✓	2
(b)	Break-even point at $n = 90$. ✓ The cobbler must make more than 90 pairs of shoes to make a profit. ✓	2
(c)	Profit = Income - Cost $P = 45n - (2880 + 13n)$ ✓ $P = 32n - 2880$	1
(d)	P = 32 x 200 – 2880 = $3520	1

Question 22		
(a)	Inverse variation: $t = \frac{k}{n}$ ✓ $20 = \frac{k}{4}$ (multiply both sides by 4) $k = 80$ ✓ $t = \frac{80}{n}$ Note – the inverse variation equation must be solved to find k in order to get 2 marks. Simply substituting in to the given equation earns one mark only.	2
(b)	$t = \frac{80}{8} = 10$ hours	1
(c)	$8 = \frac{80}{n}$ (multiply both sides by n and divide both sides by 8) $n = \frac{80}{8} = 10$ accountants	1
(d)	The graph should have the shape of a hyperbola (inverse variation) ✓ and show three labelled coordinates that the graph passes through. ✓ (The three easiest points to use would be those given or found in parts (a) through (c)). The graph must not touch the axes. ✓ 	3
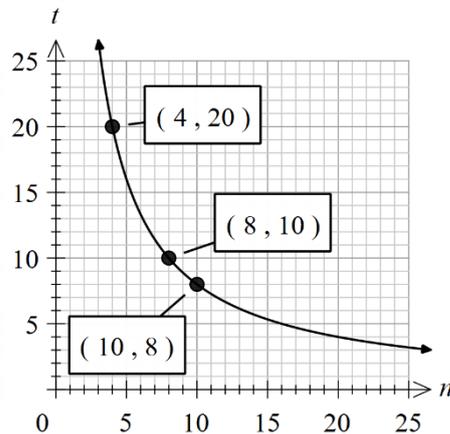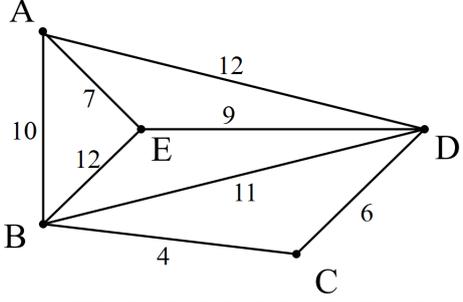
Question 23		
(a)	✓✓ All edges correctly labelled ✓ At least 4 edges correctly labelled	2
(b)	✓✓ Answer is isomorphic to the above network ✓ A spanning tree is drawn that is not the minimum spanning tree	2
(c)	$7 + 9 + 6 + 4 = 26$ ✓ \$26,000 (Diagram represents thousands of dollars.)✓	2
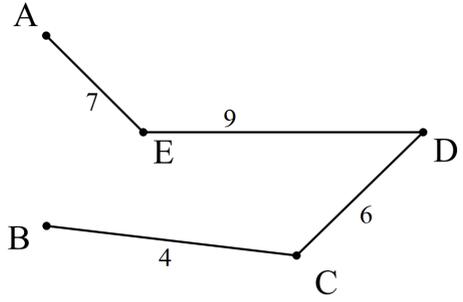
Question 24		
(a)	$\angle CAB = 360° - 312° = 48°$ $\angle NBA + \angle CAB = 180°$ (cointerior) $\therefore \angle NBA = 180° - 48° = 132°$ $\angle ABC = 132° - 42° = 90°$ ✓✓✓ All 3 pieces of information marked on the diagram and correct measure for $\angle ABC$ ✓✓ A piece of information missing from diagram and correct measure for $\angle ABC$ ✓ A piece of information missing from diagram and incorrect measure for $\angle ABC$	3

(b)	Finding length of BC: $\tan(48°) = \frac{BC}{120}$ $BC = 120 \times \tan(48°) \approx 133 \text{ km}$ ✓ Length of trip with stopover: $120 + 133 = 253 \text{ km}$ Finding length of AC: $AC^2 = BC^2 + AB^2$ $AC = \sqrt{133^2 + 120^2} \approx 179 \text{ km}$ ✓ Difference: $253 - 179 = 74 \text{ km}$ ✓	3

The diagram shows a triangle with vertices C (top), B (middle left, with right angle) and A (bottom). The side from B to A is labelled 120 km, and the angle at A is $48°$.

Question 25

Interest rate: $0.1752 \div 365 = 0.00048$ per day

Balance from 18$^{\text{th}}$ of June to 15$^{\text{th}}$ of July: 28 days (including 1$^{\text{st}}$ and last day)
$2344.52(1 + 0.00048)^{28} = \$2{,}376.24$

Purchase from 25$^{\text{th}}$ June to 15$^{\text{th}}$ July: 21 days
$210(1 + 0.00048)^{21} = \$212.13$

Purchase from 8$^{\text{th}}$ July to 15$^{\text{th}}$ July: 8 days
$53.20(1 + 0.00048)^{8} = \$53.40$

Total: $2376.24 + 212.13 + 53.40 = \$2{,}641.77$

Alternative solution:
18 June to 24 June: 7 days
Amount owing on 24 June: $2344.52(1 + 0.00048)^{7} = \$2{,}352.41$

25 June to 7 July: 13 days
Amount owing on 7 July: $(2352.41 + 210)(1 + 0.00048)^{13} = \$2{,}578.44$

8 July to 15 July: 8 days
Amount owing on 15 July: $(2578.44 + 53.20)(1 + 0.00048)^{8} = \$2{,}641.77$

✓✓✓✓ Correct answer
✓✓✓ Uses correct method and interest rate with incorrect numbers of days
✓✓ Uses correct method with incorrect interest rate and incorrect numbers of days
✓ Identifies each purchase should be treated separately.

		4

Question 26			
(a)	The width of the house is 9 times the width of the scale. $9 \times 1200 = 10800$ mm The length of the house is 7.5 times the width of the scale. $7.5 \times 1200 = 7800$ mm Total perimeter: $2 \times 10800 + 2 \times 7800 =$ 37200 mm $= 37.2$ m ✓✓ correct answer ✓ correct measurement or correct use of scale.		2
(b)	Wall area: $37.2 \times 2.4 = 89.28$ m^2 $89.28 - 15.2 = 74.08$ m^2 ✓ Materials cost: $74.08 \div 8.2 \times 30 = \$271.02$ Total cost: $271.02 + 900 = \$1171.02$ Calculating rebate: $50\% \times (1171.02 - 500) = \$335.51$ ✓ Cost to Tomyris: $1171.02 - 335.51 = \$835.51$ ✓		3

Question 27		
(a)	Area 1 : $A = \frac{1}{2} \times 110 \times (20 + 90)+ \approx 6{,}050$ m^2 ✓ Area 2 : $A = \frac{1}{2} \times 110 \times (90 + 150) \approx 13{,}200$ m^2 ✓ Total area: $6050 + 13200 = 19{,}250$ m$^2 \approx 19{,}300$ m^2 ✓	3
(b)	Volume required to reach pond: $10 \times 1{,}000{,}000 = 10{,}000{,}000$ L $10{,}000{,}000 \div 1000 = 10{,}000$ m^3 This represents 40% of the rain. Total rain volume: $10{,}000 \div 40\% = 25{,}000$ m^3 ✓ Volume $= A \times h$ $25000 = 19300 \times h$ ✓ $h = 25000 \div 19300 = 1.295$ m $= 1{,}295$ mm ✓ $\approx 1{,}300$ mm (to the nearest 10 mm) Markers note – lots of errors with unit conversions.	3

Question 28		
(a)	$P\left(47^{\circ}N, 44^{\circ}W\right), Q\left(13^{\circ}S, 44^{\circ}W\right)$	2
(b)	7 hours *using diagram - R is 7 hours ahead of P* *using text in question R is 7 hours behind P.*	1
(c)	<u>Answer for *R* 7 hours ahead of *P*</u> 11pm at *R* = 4pm at *P*. The trip is 10.5 hours so the plane must leave *P* before (4pm – 10.5h) = 5:30 am ✓ 6am at *R* = 11pm at *P*. The trip is 10.5 hours so the plane must leave *P* after (11pm – 10.5h) = 12:30 pm ✓ Plane must leave after 12.30pm and before 5:30am. ✓ If they leave *P* between 5:30am and 12:30pm they will not be able to land at *R*. <u>Answer for *R* 7 hours behind *P*</u> 11pm at *R* = 6am at *P*. The trip is 10.5 hours so the plane must leave *P* before (6am – 10.5h) = 7:30 pm ✓ 6am at *R* = 1pm at *P*. The trip is 10.5 hours so the plane must leave *P* after (1pm – 10.5h) = 2:30 am ✓ Plane must leave after 2.30am and before 7:30pm. ✓ If they leave *P* between 7:30pm and 2:30am they will not be able to land at *R*.	3

Question 29		
(a)	For two of the same pieces of fruit: $$p(AA) \; = \; \frac{4}{10} \times \frac{3}{9} = \frac{12}{90}$$ $$p(BB) = \frac{6}{10} \times \frac{5}{9} = \frac{30}{90}$$ $$p(\text{same } type) \; = \; p(AA) + P(BB) \; = \; \frac{42}{90}$$ $$p(\text{different } type) \; = \; 1 \; - \; p(\text{same } type)$$ $$= \frac{48}{90}$$ Therefore more likely to choose two different pieces of fruit.	3

Question 30	

a	$\angle AOB = \left(360^\circ - 300^\circ\right) + 78^\circ = 138^\circ$	1
	OR	
	$\angle AOB = 360^\circ - \left(300^\circ - 78^\circ\right) = 138^\circ$	
b	$$AB^2 = 37^2 + 43^2 - 2 \times 37 \times 43\cos(138^\circ) = 5582.68...$$ $$AB = \sqrt{5582.68...}$$ $$= 74.717...$$ $$\approx 75\,m \text{ (nearest } m)$$	2

Question 31		
	Deductions $= (34.50 \times 26) + (11 \times 52) = \$1469$	5
	Taxable income $= 78900 - 1469$	
	$\qquad = 77431$ ✓	
	Tax payable $= 3572 + (77431 - 37000) \times 0.325$	
	$\qquad = 16712.08$ ✓	
	Medicare levy $= 2\% \times 77431$	
	$\qquad = 1548.62$ ✓	
	Total taxes $= 16712.08 + 1548.62$	
	$\qquad = 18260.70$ ✓	
	Tax debt $= 18260.70 - 16200$	
	$\qquad = 2060.70$ ✓	
	$\therefore$ Max will have to pay $\$2060.70$	

Question 32		
(a)	$y = \frac{1}{2}x$	2

(b)	The triangle at right can be used to solve the problem. $\tan(\theta) = \frac{1}{2}$ $\theta = \tan^{-1}\left(\frac{1}{2}\right) = 26.5650 \ldots \approx 26.6°$	2

(c)	A right triangle, such as the one shown on the right, can be used to find the distance along the hill (the hypotenuse). $c^2 = a^2 + b^2$ $c^2 = 6^2 + 3^2 = 45$ $c = 6.7082 \ldots$ m ≈ 6.7 m	3

Point of Intersection (6 , 3)

Question 33

The information given can be represented with a diagram isomorphic to the one below:	6

EST 0
LST 0

10
10

18
18

30
30

START

A, 10

D, 8

G, ?

FINISH

B, ?

E, ?

C, 9

C'

F, ?

9

✓✓ Activities shown in correct order, with activities and arrows on edges. Start and finish points clearly shown.

We can first find the duration of G. As G is on the critical path, G has no float and G's duration is the EST of the next activity minus the EST of G.
∴ the duration of G is $30 - 18 = 12$ ✓

F can also be found, given F's float is 10.
float = LST of next activity – EST of this activity – duration of this activity,
So, duration = LST of next activity – EST of this activity – Float
Duration of F is $30 - 9 - 10 = 11$ ✓

We can use a similar approach for E and B, given E's float is 5.
Duration of E = 18 – EST of E – 5
Since B has no prerequisites, the EST of E is equal to the duration of B.
So, duration of E = 18 – duration of B – 5,
Giving: duration of E + duration of B = 18 – 5 = 13
Therefore, one possibility is the duration of B is 10 and the duration of E is 3.

(Other values are plausible for B and E given the restriction that their sum is 13.) ✓✓