



CATHOLIC SECONDARY SCHOOLS
ASSOCIATION OF NSW

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Centre Number

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Student Number

DO NOT REMOVE PAPER FROM EXAM ROOM

2020
TRIAL HIGHER SCHOOL CERTIFICATE
EXAMINATION

Mathematics Standard 2

Morning Session
Thursday, 20 August 2020

General Instructions

- Reading time – 10 minutes
- Working time – 2½ hours
- Write using **black pen**
- NESA approved calculators may be used
- A Reference Sheet is provided on a SEPARATE sheet
- Use the Multiple-Choice Answer Sheet provided for Section I
- In Section II, show relevant mathematical reasoning and/or calculations
- Write your Centre Number and Student Number on the top of this page and on each question page where indicated

Total marks – 100

Section I Pages 2-9

15 marks

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

Section II Pages 10-27

85 marks

- Attempt Questions 16-44
- Allow about 2 hours and 5 minutes for this section

Disclaimer

Every effort has been made to prepare these 'Trial' Higher School Certificate Examinations in accordance with the NESA documents, Principles for Setting HSC Examinations in a Standards-Referenced Framework and Principles for Developing Marking Guidelines Examinations in a Standards Referenced Framework. No guarantee or warranty is made or implied that the 'Trial' Examination papers mirror in every respect the actual HSC Examination question paper in any or all courses to be examined. These papers do not constitute 'advice' nor can they be construed as authoritative interpretations of NESA intentions. The CSSA accepts no liability for any reliance use or purpose related to these 'Trial' question papers. Advice on HSC examination issues is only to be obtained from the NESA.

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Section I

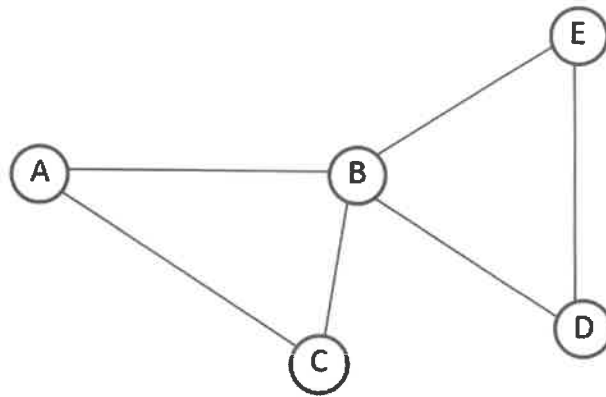
15 marks

Attempt Questions 1-15

Allow about 25 minutes for this section

Use the Multiple-Choice Answer Sheet for Questions 1-15.

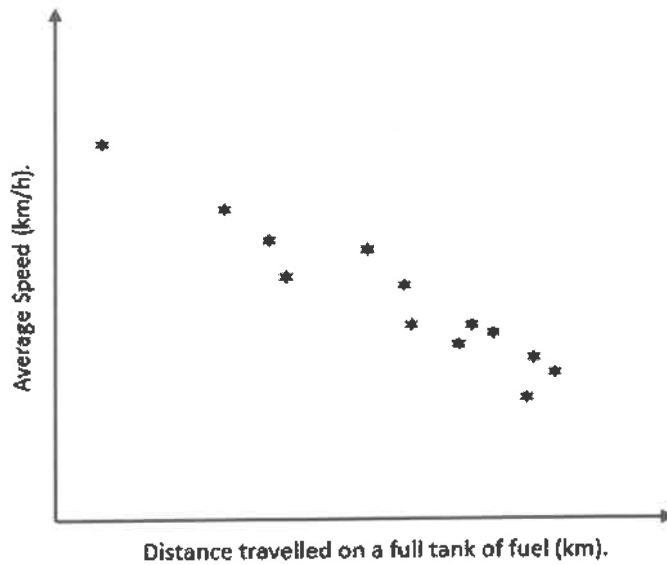
- 1 A network is shown below.



What is the degree of vertex B?

- (A) 2
 - (B) 3
 - (C) 4
 - (D) 5
- 2 Millie has a loan for \$80 000 to be repaid in monthly instalments of \$895 over 10 years.
- How much interest will Millie pay on this loan?
- (A) \$27 400
 - (B) \$88 950
 - (C) \$90 740
 - (D) \$107 400

3 Bivariate data is shown in the scatterplot below.



What is the strength and direction of the correlation displayed?

- (A) Weak and positive
- (B) Weak and negative
- (C) Strong and positive
- (D) Strong and negative

4 Chelsea runs every day.

Last week she ran the following distances, in kilometres:

Mon	Tues	Wed	Thurs	Fri	Sat	Sun
6.9	7.7	4.1	9.9	9.5	10.3	7.1

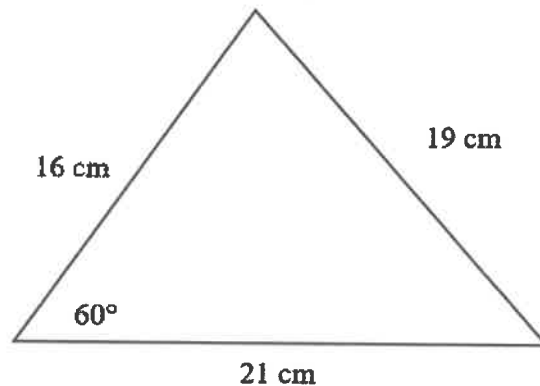
What is the median distance that Chelsea ran last week?

- (A) 6.2 km
- (B) 7.7 km
- (C) 7.9 km
- (D) 9.9 km

- 5 A box of chocolates with contents weighing 600 grams has hard centred chocolates and soft centred chocolates in the ratio of 9:6

What is the weight of the soft centred chocolates?

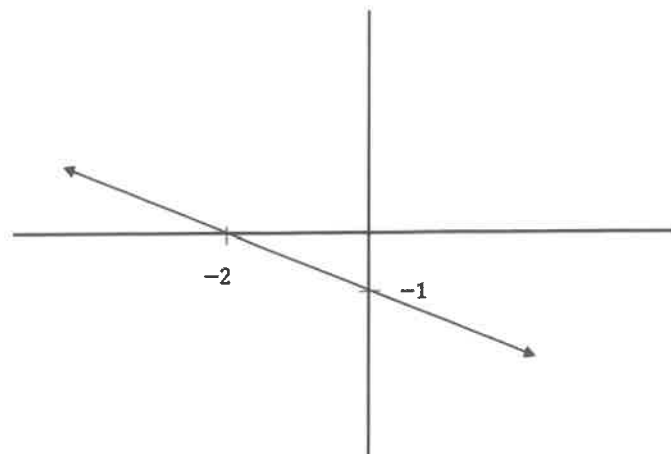
- (A) 40 g
(B) 100 g
(C) 240 g
(D) 400 g
- 6 Which of the following expressions gives the area of the triangle below?



NOT TO
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- (A) $\text{Area} = \frac{1}{2} \times 16 \times 19 \times \cos 60^\circ$
(B) $\text{Area} = \frac{1}{2} \times 16 \times 21 \times \cos 60^\circ$
(C) $\text{Area} = \frac{1}{2} \times 16 \times 19 \times \sin 60^\circ$
(D) $\text{Area} = \frac{1}{2} \times 16 \times 21 \times \sin 60^\circ$

7 What is the equation of the line below?



- (A) $y = -x - 1$
- (B) $y = -x - 2$
- (C) $y = -2x - 1$
- (D) $y = -\frac{1}{2}x - 1$

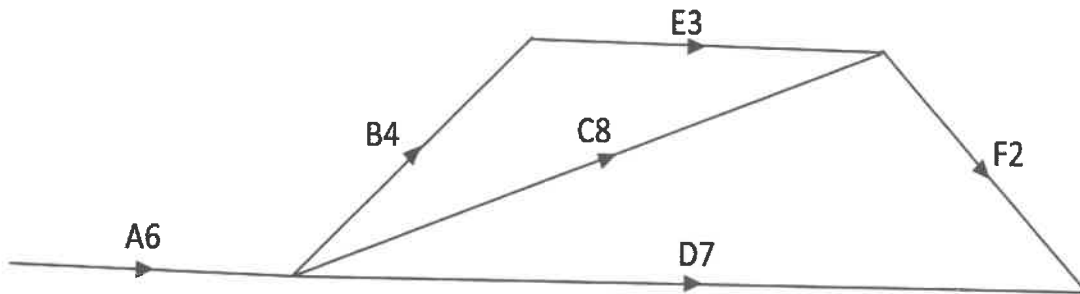
8 Dominic collected the following nutritional information about his favourite snack foods.

Food	Portion Size	Energy
Chocolate	20 g	500 kJ
Cream Biscuits	30 g	600 kJ
Cheesecake	50 g	600 kJ
Fruit Cake	50 g	700 kJ
Peanut Butter	50 g	1800 kJ

Which of the following snacks would provide less energy than 50 grams of chocolate?

- (A) 40 g of peanut butter
- (B) 100 g of cheesecake
- (C) 100 g of cream biscuits
- (D) 150 g of fruit cake

9 A network diagram to complete a series of tasks is given below.



Which series of tasks is the critical path?

- (A) AD
 - (B) ACF
 - (C) ABEF
 - (D) ABCDEF
- 10 A cruise ship left Sydney (34°S , 151°E) to travel to the island of Samos in Greece.

When the ship arrived in Samos, it was 72° north and 124° west of Sydney.

What is the location of Samos?

- (A) (38°N , 27°E)
- (B) (38°N , 95°E)
- (C) (106°N , 27°E)
- (D) (106°N , 95°E)

- 11 Lola is a 2-year-old girl requiring medicine for an illness.

Her doctor looks at using either Fried's formula or Young's formula to calculate the required dose.

$$\text{Fried's formula: Dosage for child} = \frac{\text{age of child (in months)} \times \text{adult dosage}}{150}$$

$$\text{Young's formula: Dosage for child} = \frac{\text{age of child (in years)} \times \text{adult dosage}}{\text{age of child (in years)} + 12}$$

Given that the adult dosage of the medicine is 100 mL, which of the following is true for Lola, if her dosage is rounded to the nearest mL?

- (A) The required dosage is 2 mL larger using Fried's formula.
 - (B) The required dosage is 13 mL larger using Young's formula.
 - (C) The required dosage is 51 mL larger using Young's formula.
 - (D) Both formulae result in the same recommended dosage.
- 12 Henry has 6 black socks and 5 white socks in a basket. Without looking, he randomly selects two socks out of the basket.

What is the probability that Henry has selected a pair of matching socks?

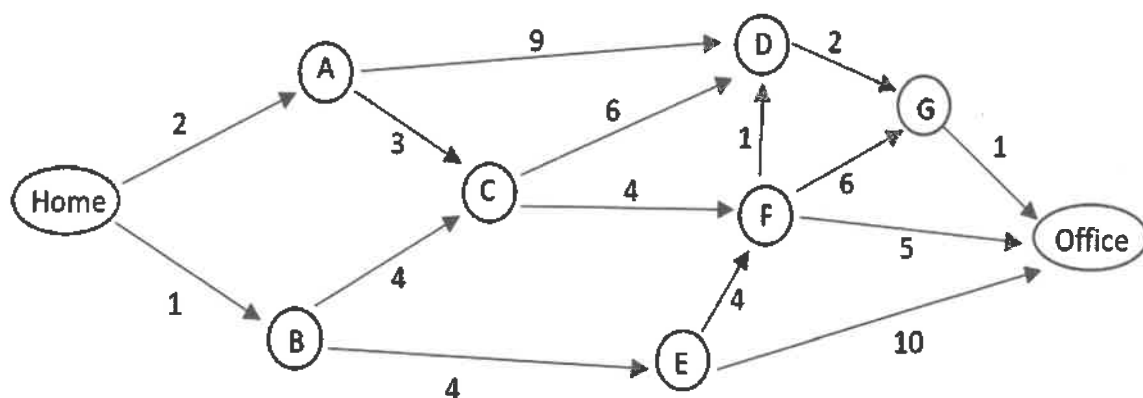
- (A) $\frac{2}{11}$
- (B) $\frac{3}{11}$
- (C) $\frac{5}{11}$
- (D) $\frac{6}{11}$

13 For a normally distributed set of scores, which of the following statements is FALSE?

- (A) A z-score more than 2 has a higher probability than a z-score more than 1
- (B) The frequency distribution is symmetrical about the mean
- (C) The z-score of a score describes how far that score is from the mean
- (D) The mean and the median are approximately equal

14 The network diagram below shows the possible routes that Tim can take to get from home to his office.

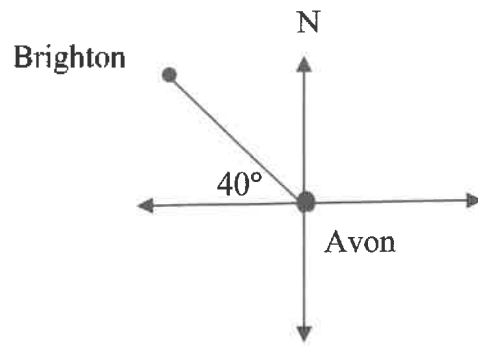
The weightings on the edges show the time taken, in minutes, to travel.



Assuming there are no delays, what is the shortest time that Tim can get from home to his office?

- (A) 11 minutes
- (B) 13 minutes
- (C) 14 minutes
- (D) 15 minutes

15 The compass bearing of Avon from Brighton as shown in the diagram is:



- (A) N40°W
- (B) S40°E
- (C) S50°W
- (D) S50°E

Section II

85 marks

Attempt Questions 16 - 44

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.

Question 16 (2 marks)

Suzie attended a party. At the party she consumed 5 standard drinks over 3 hours. 2

Given that Suzie weighs 75 kg, use the formula below, to calculate her Blood Alcohol Content (BAC) correct to three decimal places.

$$BAC_{female} = \frac{10N - 7.5H}{5.5M}$$

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

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Question 17 (2 marks)

Ray watches television for 5 hours every day. His television uses 300 watts per hour and his electricity is charged at \$0.30/kWh. 2

How much does it cost Ray to run his television for a year?

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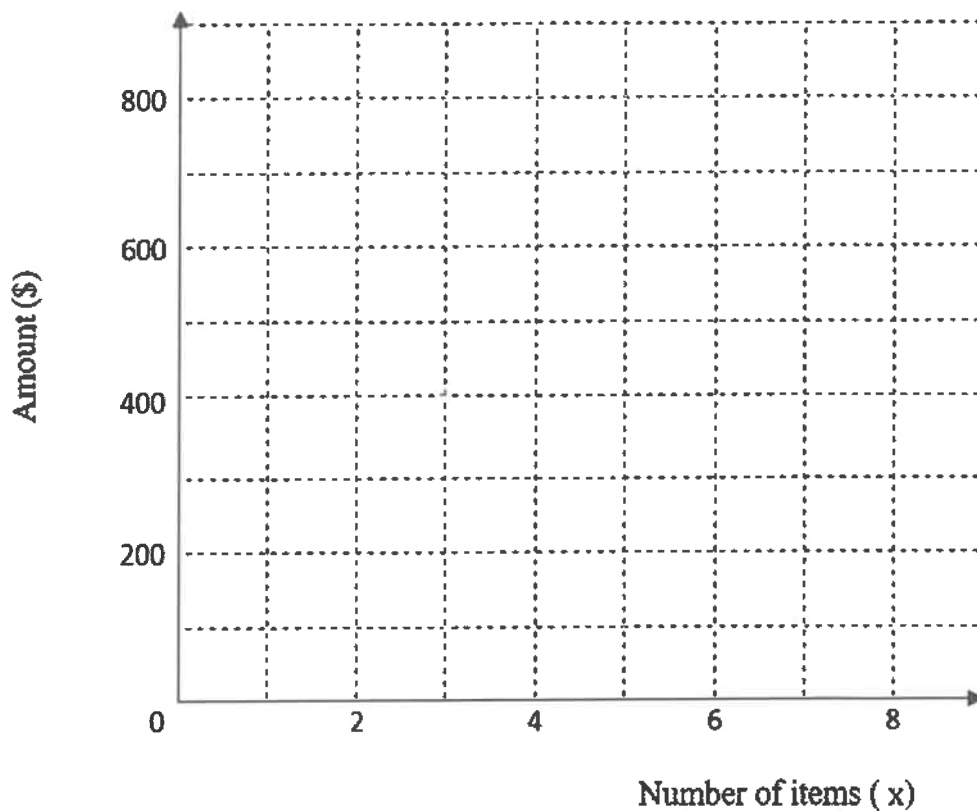
Question 18 (3 marks)

Michael has a small manufacturing business.

The cost of manufacturing is given by the equation, $C = 50x + 200$ and the income earned is given by the equation, $I = 100x$, where x is the number of items that the business has manufactured.

- (a) Graph both equations on the grid below.

2



- (b) How many items need to be manufactured for the business to break even?

1

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Question 19 (2 marks)

The table below shows the percentage of Australian adults from each of the different blood groups. **2**

O		A		B		AB	
O+	O-	A+	A-	B+	B-	AB+	AB-
40%	9%	31%	7%	8%	2%	2%	1%

Last week 1200 adults visited a medical clinic. How many of these people would be expected to have blood group A?

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Question 20 (4 marks)

Molly has a current annual salary of \$92 000. She is offered three options for an increase in pay. **4**

Option A – An additional \$3600 per year for the next 5 years.

Option B – A flat rate increase of 3% of her current salary per year for the next 5 years.

Option C – An increase of 3% p.a. compounding each year for the next 5 years.

Which option will give Molly the biggest pay increase? Justify your answer with calculations.

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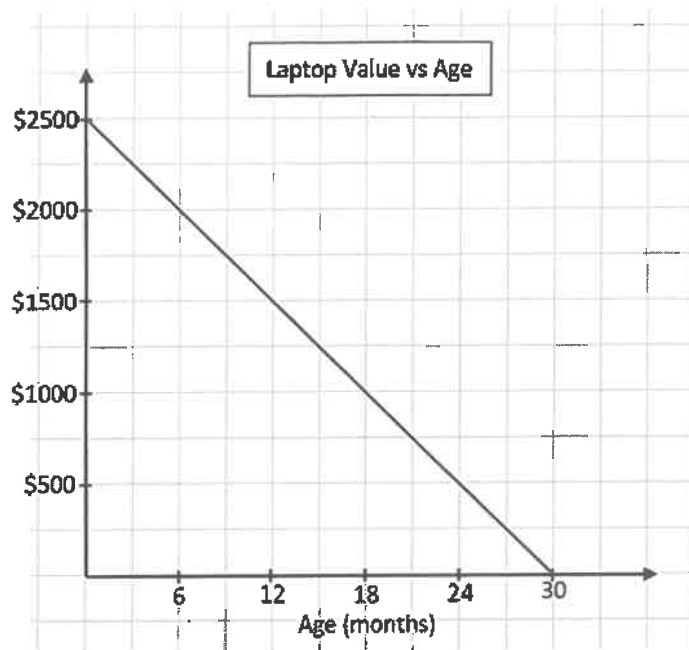
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Question 21 (2 marks)

The graph below shows the depreciation of a laptop over time.

2



What is the gradient of the function and what does it represent?

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Question 22 (3 marks)

Solve the equation:

3

$$\frac{m}{3} = 2m - 1$$

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Question 23 (3 marks)

Izmir contributes \$250 per quarter for 3 years into an annuity that earns 4.8% p.a. compounded quarterly.

3

Use the table below to calculate the amount of interest that the annuity earns.

Period	Future value interest factors for an annuity of \$1			
	Interest rate (per period)			
	0.2%	1.2%	2.4%	4.8%
1	1.00000	1.00000	1.00000	1.00000
3	3.00600	3.03614	3.07258	3.14630
6	6.03008	6.18291	6.37173	6.76777
12	12.13288	12.82455	13.71783	15.73407
24	24.56018	27.62273	31.95196	43.35108

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Question 24 (2 marks)

Jessica owns 5000 shares in a company. The shares have a current value of \$8.20 each.

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Jessica receives a dividend payment of \$6000.

What is the dividend yield on the shares? Give your answer correct to one decimal place.

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Question 25 (3 marks)

The profit, P , in dollars, on a fundraising event is given by the formula,

$$P = 18n - 400$$

where n is the number of guests attending the event.

- (a) Calculate the profit if 200 guests attend the event. **1**

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- (b) Change the subject of the formula, $P = 18n - 400$, to n . **1**

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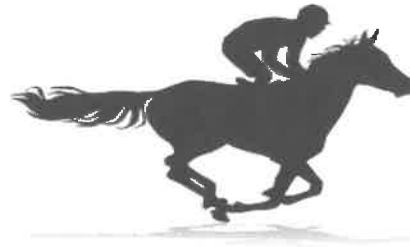
- (c) Determine the number of guests required for the event to make a profit of \$5000. **1**

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Question 26 (2 marks)

Kingston Rule is the name of the racehorse that won the 1990 Melbourne Cup.

2



Kingston Rule still holds the record for the fastest Melbourne Cup ever run, covering the 3200 metres distance in 3 minutes 16 seconds.

Calculate, correct to one decimal place, *Kingston Rule*'s average speed in km/h.

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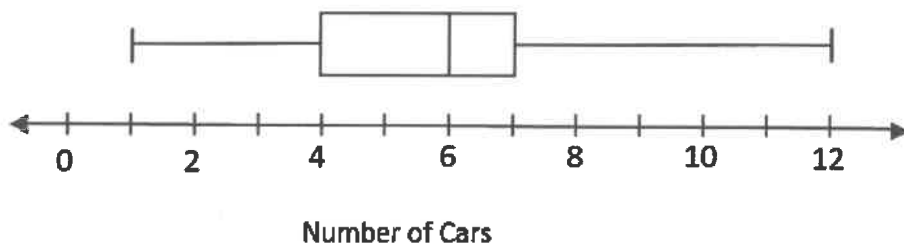
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Question 27 (3 marks)

Sally recorded the number of cars in the carpark each day.

3

She displayed the data in the box plot below:



Is the maximum score an outlier for this data? Justify your answer with mathematical calculations.

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Question 28 (5 marks)

Rob is looking to buy a new car and is comparing the cost of an electric car and a petrol car.

Rob has gathered the following information.

	Electric car	Petrol car
Purchase price	\$48 800	\$29 990
On-road costs	\$900/year	\$1600/year
Petrol		\$1.49/L
Electricity	\$0.25/kWh	
Fuel Consumption	15 kWh/100 km	7.6 L/100 km
Servicing	\$450/year	\$2000/year

Rob drives an average of 25 000 km per year and he intends to own his new car for 5 years.

Determine which car you would recommend Rob to purchase by calculating the expected cost of purchasing and running each car for 5 years.

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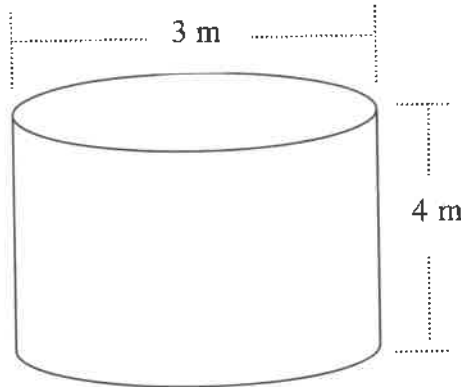
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Question 29 (2 marks)

A cylindrical water tank is 3 metres in diameter and has a height of 4 metres.

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What is the capacity, to the nearest litre, of the water tank? ($1 \text{ m}^3 = 1 \text{ kL}$)

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Question 30 (3 marks)

Nicholas owns a Christmas Tree Farm.

The height of the Christmas trees that Nicholas sells are normally distributed with a mean of 2.4 metres and a standard deviation of 20 cm.

(a) How many standard deviations above the mean is a Christmas tree that is 2.9 metres tall? 1

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(b) What is the range in height of 95% of the Christmas trees that Nicholas sells? 2

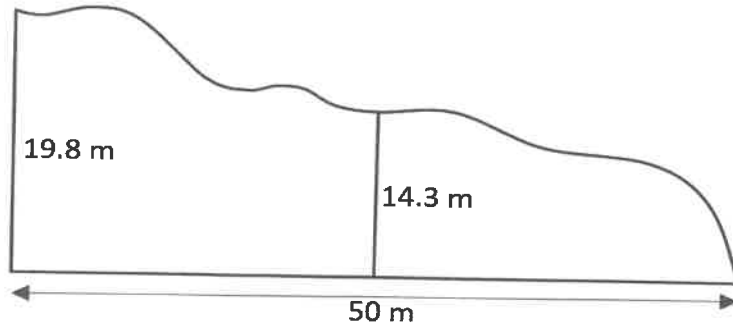
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Question 31 (3 marks)

A plan of Thredbo Park that borders the Snowy River is shown below.



NOT TO SCALE

Overnight 12 cm of snow fell on the park.

With the aid of two applications of the Trapezoidal Rule, estimate the volume of snow that fell on the park.

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Question 32 (2 marks)

The time, t , taken to travel by train between Sydney and Newcastle varies inversely with the speed, s , of the train.

The travel time is 2 hours 15 minutes when the train is travelling at 100 km/h.

What is the travel time between Sydney and Newcastle when the train travels at 60 km/h?

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Question 33 (2 marks)

A netball court is measured to be 15.2 metres wide.

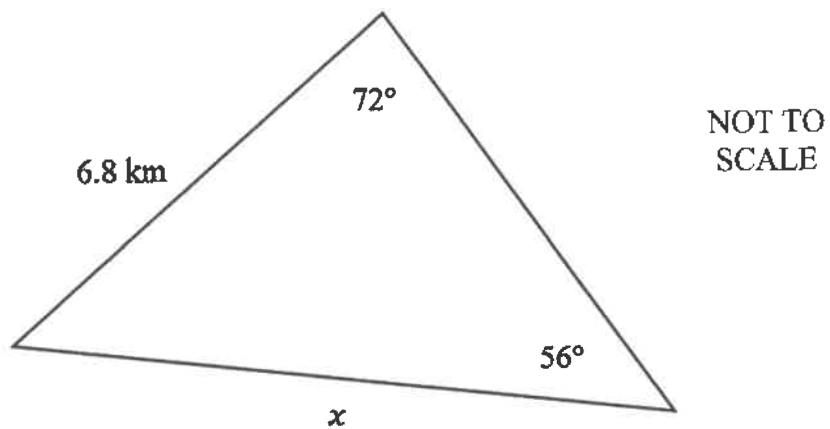
2

What is the percentage error, correct to three decimal places, for this measurement?

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Question 34 (2 marks)

2



Calculate the value of x , correct to two significant figures.

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Question 35 (2 marks)

Tokyo has a Coordinated Universal Time (UTC) of +9.

2

Washington DC has a Coordinated Universal Time (UTC) of -5.

What day and time will it be in Washington DC when it is 8 pm on Sunday in Tokyo?

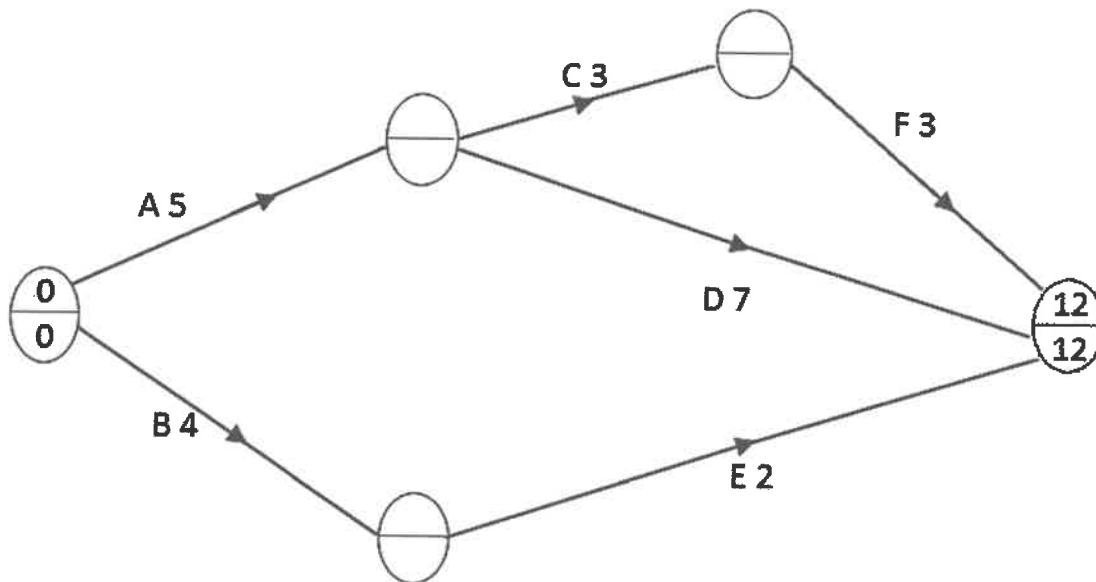
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Question 36 (3 marks)

A marketing project is made up of six activities. The project designer has drawn a network diagram showing the number of hours each activity will take.



(a) On the network diagram above, fill in the Earliest Starting Time (EST) and Latest Starting Time (LST) for each activity. 2

(b) What is the float time for activity E? 1

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Question 37 (5 marks)

Seven students who are still on their Learner’s Permit recorded the number of driving hours that they have logged so far and the mark that they scored in their Visual Art assessment task.

The results are recorded in the table below:

Name	Ally	Bree	Cain	Dan	Elle	Frank	Guy
Hours of driving (x)	63	68	72	76	82	84	91
Visual Art mark (y)	73	71	71	85	92	80	81

- (a) Calculate Pearson's correlation coefficient for the data, correct to two decimal places. 1

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- (b) Calculate the value, to two decimal places, of the gradient and the y -intercept. Use these values to write the equation of the least-squares line of best fit. 2

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- (c) Another student who has logged 55 hours of driving and who scored 94 in Visual Art is added to the data. 1

Describe the impact this addition to the data will have on Pearson’s correlation co-efficient.

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- (d) A student made the statement, 1

“Doing well in Visual Art depends on how much driving you have done.”

Based on the data, justify whether you agree or disagree with the statement.

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Question 38 (2 marks)

A set of scores is normally distributed. A score of 12 has a z-score of -2 while a score of 21 has a z-score of $+1$.

2

Calculate the mean of the scores.

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Question 39 (2 marks)

A cup of coffee is cooling according to the following exponential formula,

$$C = 21 + (74 \times 3^{-0.2t})$$

where C is the temperature in degrees Celsius and t is the time in minutes since the coffee was poured.

- (a) Calculate the initial temperature of the coffee.

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- (b) Calculate the temperature, correct to the nearest degree, of the coffee after 10 minutes.

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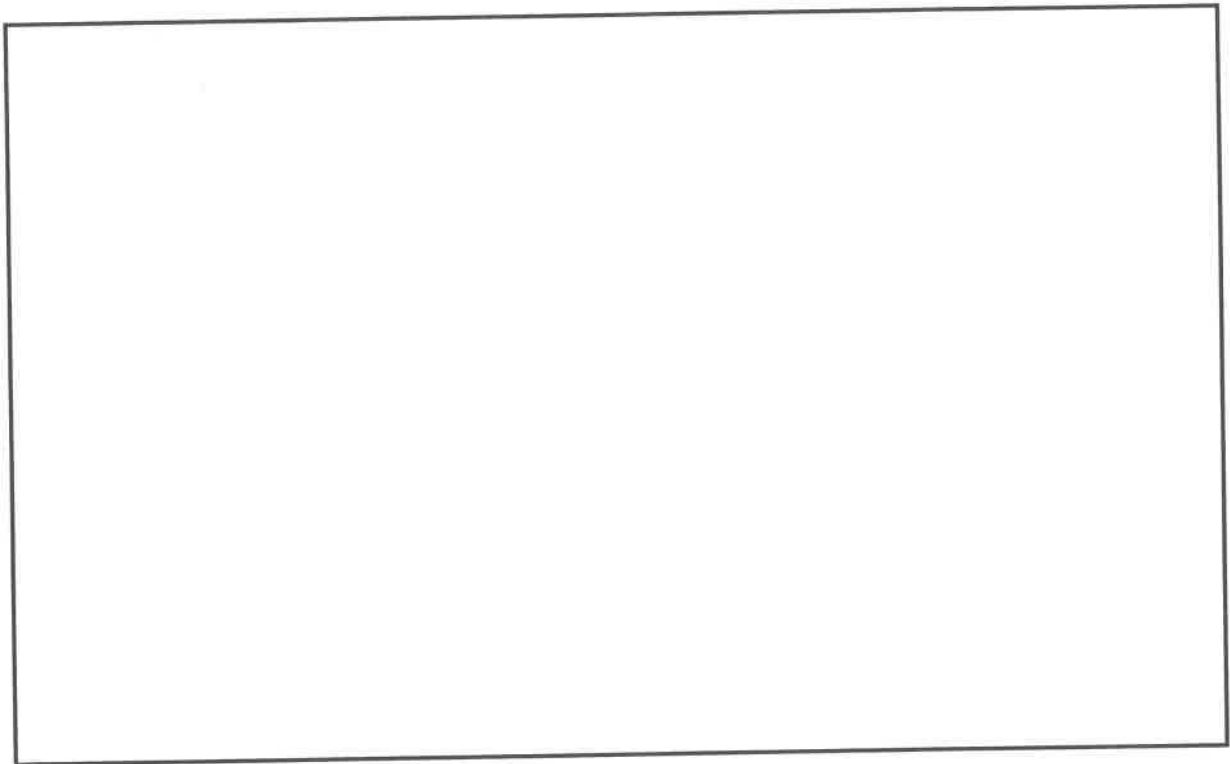
Question 40 (4 marks)

The distances (in metres) between different buildings in a school are shown in the table below.

	A	B	C	D	E
A	-	200	150	400	
B	200	-	450		100
C	150	450	-	250	200
D	400		250	-	200
E		100	200	200	-

- (a) Use the information in the table to complete a weighted network diagram in the space below.

2



- (b) Computer cabling is to be installed to each of the buildings.

2

By showing a minimum spanning tree on the network that you have drawn, calculate the least amount of computer cabling that is needed to connect all the buildings.

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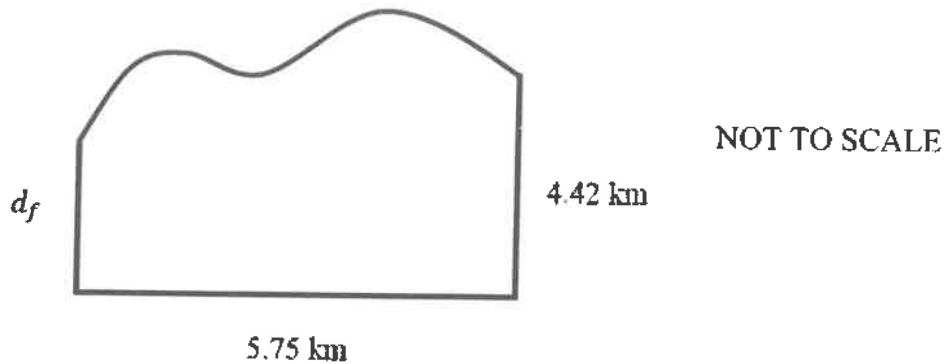
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Question 41 (2 marks)

Kerry has a large farm with an irregular boundary, as shown below.

2



When approximated using one application of the trapezoidal rule, the area of the farm is 24.15 km^2 .

What is the length of the first measurement, d_f , of the farm?

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Question 42 (4 marks)

Eric has replaced all the old light globes in his home with new energy efficient LED globes.

4

Eric's home contains:

Power of old globe	Number of globes	Power of LED globe
60 watt	15	7 watt
100 watt	5	12 watt

Each light is used for an average of 40 hours each week and his cost of electricity is 25.367 c/kWh.

How much will Eric save on his electricity costs in a year by switching to LED globes?

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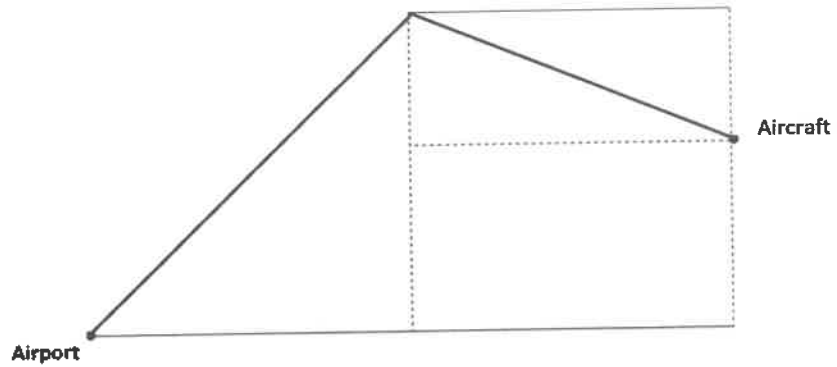
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Question 43 (5 marks)

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An aircraft took off from an airport on an angle of elevation of 30° until it reached a maximum height of 12 000 metres.

The aircraft then descended on an angle of depression of 20° to a new height of 9000 metres.



Find the straight-line distance of the aircraft to the airport when it first reaches the new height of 9000 metres, correct to the nearest metre.

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Question 44 (6 marks)

Joanne plans to invest \$6500 at the start of each month into an online investment saver bank account over three months starting in October.

Interest will be compounded daily and paid at the end of each month. The interest rate per annum for each month is shown in the following table.

October	4.50% p.a.
November	4.25% p.a.
December	4.00% p.a.

- (a) Show that the future value of Joanne's investment at the end of December is \$19 637.06

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- (b) Joanne is offered an alternative investment option of a lump sum investment into a term deposit for three months, compounded monthly at 3.2% p.a.

2

What present value must Joanne invest into the term deposit in order to have the same future value of \$19 637.06?

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Section II Extra Writing Space

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

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EXAMINERS

Julie Sligar (Convenor)
Mark Barnes
Rebecca Charlesworth
Michael Zaouk

St Gregory's College, Campbelltown
Marist Catholic College, Penshurst
Red Bend Catholic College, Forbes
St Ursula's College, Kingsgrove

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CSSA HSC TRIAL EXAMINATION

Mathematics Standard 2

REFERENCE SHEET

Measurement

Limits of accuracy

$$\text{Absolute error} = \frac{1}{2} \times \text{precision}$$

$$\text{Upper bound} = \text{measurement} + \text{absolute error}$$

$$\text{Lower bound} = \text{measurement} - \text{absolute error}$$

Length

$$l = \frac{\theta}{360} \times 2\pi r$$

Area

$$A = \frac{\theta}{360} \times \pi r^2$$

$$A = \frac{h}{2}(a + b)$$

$$A \approx \frac{h}{2}(d_f + d_l)$$

Surface area

$$A = 2\pi r^2 + 2\pi rh$$

$$A = 4\pi r^2$$

Volume

$$V = \frac{1}{3}Ah$$

$$V = \frac{4}{3}\pi r^3$$

Trigonometry

$$\sin A = \frac{\text{opp}}{\text{hyp}}, \quad \cos A = \frac{\text{adj}}{\text{hyp}}, \quad \tan A = \frac{\text{opp}}{\text{adj}}$$

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

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

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

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

Financial Mathematics

$$FV = PV(1 + r)^n$$

Straight-line method of depreciation

$$S = V_0 - Dn$$

Declining-balance method of depreciation

$$S = V_0(1 - r)^n$$

Statistical Analysis

An outlier is a score

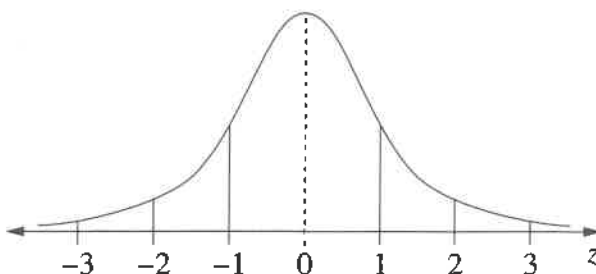
$$\text{less than } Q_1 - 1.5 \times IQR$$

or

$$\text{more than } Q_3 + 1.5 \times IQR$$

$$z = \frac{x - \bar{x}}{s}$$

Normal distribution



- approximately 68% of scores have z-scores between -1 and 1
- approximately 95% of scores have z-scores between -2 and 2
- approximately 99.7% of scores have z-scores between -3 and 3

6000-4

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Centre Number

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Student Number

**CATHOLIC SECONDARY SCHOOLS ASSOCIATION OF NSW
YEAR 12 TRIAL HIGHER SCHOOL CERTIFICATION EXAMINATION
MATHEMATICS STANDARD 2 – MULTIPLE CHOICE ANSWER SHEET**

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 have changed 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:

A B ^{correct} C D

ATTEMPT ALL QUESTIONS

- | | | | | | |
|-----------------|----|-------------------------|-------------------------|-------------------------|-------------------------|
| Question | 1 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 2 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 3 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 4 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 5 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 6 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 7 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 8 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 9 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 10 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 11 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 12 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 13 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 14 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 15 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |

