

**2012
SEMESTER 1
EXAMINATION**

Student Number

General Mathematics



General Instructions

- Reading time – 5 minutes
- Working time - 2 ½ hours
- Write using blue or black pen
- Calculators may be used
- A formulae sheet is provided on a separate sheet

Total Marks – 100

Section I: 25 marks

- Attempt questions 1-25
- Allow about 30 minutes for this section

Section 2: 75 marks

- Attempt questions 26-30
- Allow about 2 hours for this section

Section I

25 marks

Attempt Questions 1–25

Allow about 30 minutes for this section

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

A B C D
correct

1. The pay slip below has some missing amounts. What amount should be in the Total Pay section?

PAY SLIP			
Pay for hours worked at:			
Normal Time	38		\$425.60
Overtime - (time-and-a-half)	4		
Total Pay			

- (A) \$470.40
(B) \$429.60
(C) \$515.20
(D) \$492.80
2. The measurement 7320 mm is to be rounded to 2 significant figures. Choose the correct answer:
- (A) 73 mm
(B) 7300 mm
(C) 72 mm
(D) 732 cm
3. Given that $r = 5.2$ and $h = 7.6$, calculate the value of S to 2 decimal places using the formula $S = 2\pi r(r + h)$.
- (A) 418.20
(B) 80.42
(C) 418.21
(D) 177.50
4. The probability of selecting an orange jellybean from a bag of jellybeans is known to be 0.23. What percentage of the jellybeans in the bag is **not** orange?
- (A) 23%
(B) 77%
(C) 50%
(D) 55%

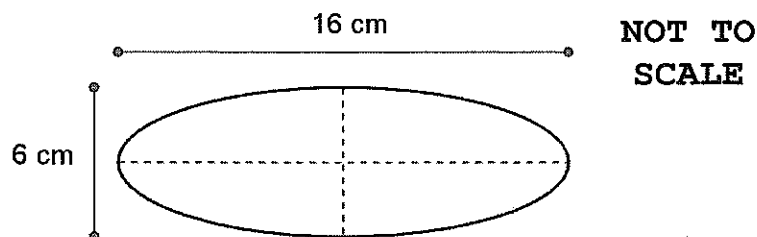
5. A statistician was hired to estimate the number of fish in a lake. In his first sample, 2 400 fish were taken from the lake, tagged and returned to the lake. The next day a random sample of 5000 fish was caught and contained 1955 tagged fish. The approximate number of fish in the lake was calculated to be:

- (A) 9 355
- (B) 7 400
- (C) 6 138
- (D) 6 955

6. Georgia wants to know the present value of an annuity which will earn 3% per annum, compounded monthly. In ten years time, the future value will be \$5000. Which calculation will result in the correct answer?

- (A) $N = \frac{5000}{(1 + 0.03)^{10}}$
- (B) $N = \frac{5000}{(1 + 0.03)^{120}}$
- (C) $N = \frac{5000}{(1 + 0.03 \div 12)^{10}}$
- (D) $N = \frac{5000}{(1 + 0.03 \div 12)^{120}}$

7. The approximate area of the ellipse below is:



- (A) 75 cm²
- (B) 96 cm²
- (C) 302 cm²
- (D) 69 cm²

8. Jane purchased a new laptop for her business at the end of 2009 for \$3 990. Use the declining balance method to determine the value of the laptop at the end of 2011, using a depreciation rate of 30% per annum.

The value of the laptop to the nearest dollar is:

- (A) \$558
- (B) \$1 955
- (C) \$2 394
- (D) \$1 197

9. Which statistical measure is most affected by outliers?

- (A) mean
- (B) median
- (C) mode
- (D) interquartile range

10. Tim has just received his credit card statement. He has been charged 18.25 % per annum on his outstanding balance of \$475, which was outstanding for 24 days.

He has noticed errors on his credit card statements before and wishes to check the amount of interest that he should have been charged.

Which calculation should he use?

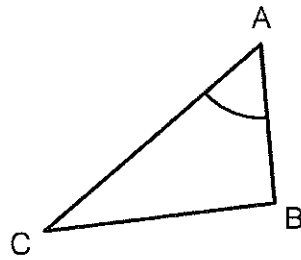
- (A) $\$475 \times \frac{0.05}{100} \times 24$
- (B) $\$475 \times \frac{18.25}{100} \times 24$
- (C) $\$475 \times \frac{18.25}{365} \times 24$
- (D) $\$475 \times \frac{0.05}{365} \times 24$

11. The location of Town X is 35°N 30°E. The location of Town Y is 65°N 105°E.

Which of the following is true? (Ignore day-light savings.)

- (A) Town X is five hours ahead of Town Y.
- (B) Town X is two hours ahead of Town Y.
- (C) Town X is five hours behind Town Y.
- (D) Town X is two hours behind Town Y.

12. In $\triangle ABC$, $AC = 32$ m, $AB = 22$ m, $BC = 20.8$ m and $\angle CAB = 40^\circ 12'$.
What is the area of the triangle to the nearest square metre?



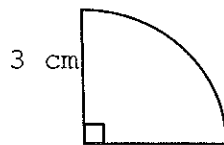
**NOT TO
SCALE**

- (A) 352 m^2
 (B) 148 m^2
 (C) 227 m^2
 (D) 272 m^2
13. Geoffrey is a race car driver. His lap times are recorded along with the average lap times of all competitors (including Geoffrey) in the table below:

Lap Number	Geoffrey's Lap Time	Average lap time for all competitors
1	2 minutes 18 seconds	2 minutes 19 seconds
2	1 minute 58 seconds	2 minutes 3 seconds

Which of the following statements is definitely true?

- (A) All the drivers completed their second lap faster than their first lap.
 (B) When compared to other competitors, Geoffrey's second lap time was better than his first lap time.
 (C) Geoffrey slowed down on his second lap.
 (D) Geoffrey was the fastest driver overall.
14. What is the perimeter of the quadrant shown below, to the nearest centimetre?



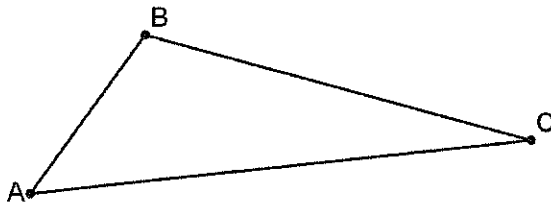
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- (A) 7 cm
 (B) 8 cm
 (C) 10 cm
 (D) 11 cm

15. The straight lines with equations $3x + y = 1$ and $x + y = 3$ intersect at point A. The coordinates of A are:

- (A) (1, 3)
- (B) (3, 1)
- (C) (-1, 3)
- (D) (-1, 4)

16. In $\triangle ABC$, $AB = 4$ cm, $BC = 7$ cm and $AC = 9$ cm. The size of the largest angle is closest to:



**NOT TO
SCALE**

- (A) 107°
- (B) 113°
- (C) 51°
- (D) 121°

17. Fiona decides to make voluntary contributions to her superannuation fund. She will put in \$50 per week until she retires in 26 years time.

Fiona's superannuation fund earns 5.2% per annum and is compounded weekly.

To the nearest dollar, at retirement, Fiona will have superannuation amounting to:

- (A) \$143 127
- (B) \$5 600 000
- (C) \$2 631
- (D) \$143 126

18. $x^5(x^6 - 2x^2)$ when expanded equals:

- (A) $x^2 - 2x^7$
- (B) $x^{11} - 2x^7$
- (C) $x^{30} - 2x^{10}$
- (D) $2x^{30} - 3x^{10}$

19. The Merino Sheep Company records the amount of rain in the rain gauge each morning at 8.00am. Which of the following best describes the type of data collected?

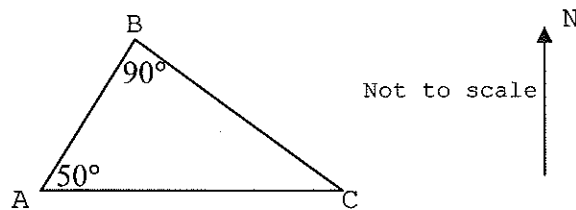
- (A) Discrete
- (B) Stratified
- (C) Categorical
- (D) Continuous

20. Sven throws 3 darts at a dartboard 15 times and records his scores in a stem and leaf plot. After a visit to the spa Sven repeats the experiment.

Before Spa			After Spa			
9	1	20				
9	8	30	5			
8	7	40	7			
8	6	50	3	8		
6	4	60	1	2	6	7
		70	1	3	4	5
		80	1	1	2	
		90				

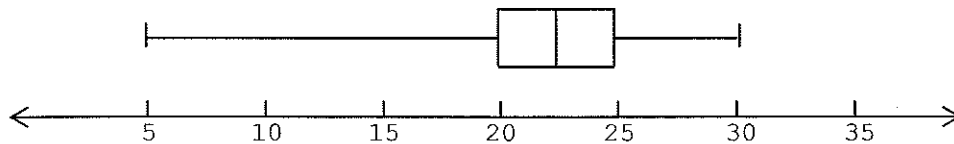
Which of the statements below is true?

- (A) The mean has increased and the range has increased
 (B) The range has risen but the mean has fallen
 (C) Both the mean and the range have decreased
 (D) The mean has increased and the range has decreased
21. Three towns A, B and C are situated as shown in the diagram. C is due east of town A.



The bearing of C from B is

- (A) 040° (B) 130° (C) 140° (D) 310°
22. Which of the following is **not** true of the data represented in the box and whisker plot below:



- (A) $\frac{1}{4}$ of the scores are between 5 and 20
 (B) $\frac{1}{2}$ of the scores are between 20 and 25
 (C) the lowest $\frac{1}{4}$ of the data is spread over a wide range
 (D) most of the data is contained between the scores of 5 and 20

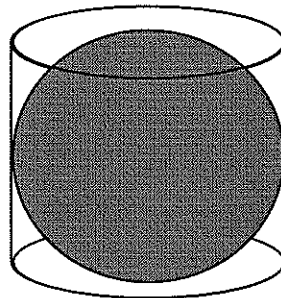
23. Look at the table of monthly loan repayments per \$1000 shown below.

Term	Interest Rate (p.a.)			
	9%	10%	11%	12%
10	\$12.67	\$13.22	\$13.78	\$14.35
15	\$10.14	\$10.75	\$11.37	\$12.00
20	\$9.00	\$9.65	\$10.32	\$11.01
25	\$8.39	\$9.09	\$9.80	\$10.53

Daniel has an \$80 000 mortgage at 10% p.a. over 10 years. After interest rates rise to 12% Daniel extends the term of his loan to 15 years.

What is the change in Daniel's monthly repayments?

- (A) They increased by \$1.13 per month
 - (B) They decreased by \$1.22 per month
 - (C) They increased by \$90.40 per month
 - (D) They decreased by \$97.60 per month
24. A sphere fits exactly into a cylindrical container as shown below.

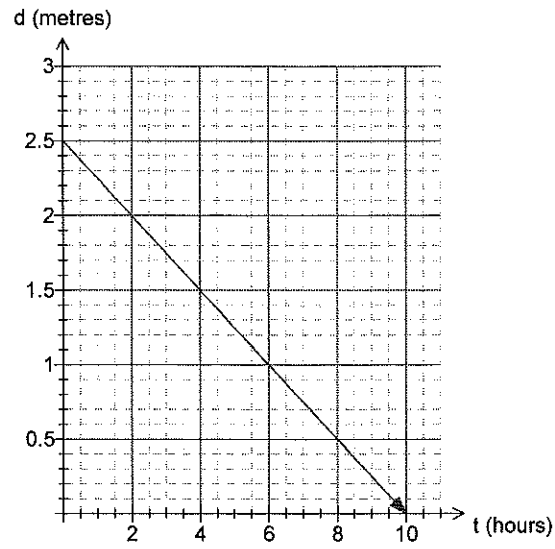


If the diameter of the sphere is 20cm, the volume of the cylinder to the nearest cubic centimetre is:

- (A) 3 142 cm³
- (B) 6 283 cm³
- (C) 12 566 cm³
- (D) 25 132 cm³

25.

A swimming pool was emptied and the depth of water recorded as it fell. The graph below shows the change in depth.



What is the equation of the depth of water over time?

- (A) $d = 2.5 - 0.25t$
- (B) $d = t + 0.25$
- (C) $d = 2.5$
- (D) $d = 0.25t + 2.5$

END OF SECTION I

Section II

75 marks

Attempt Questions 26-30

Allow about 2 hours for this section

Answer each question in a SEPARATE writing booklet. Extra writing booklets are available.
All necessary working should be shown in every question.

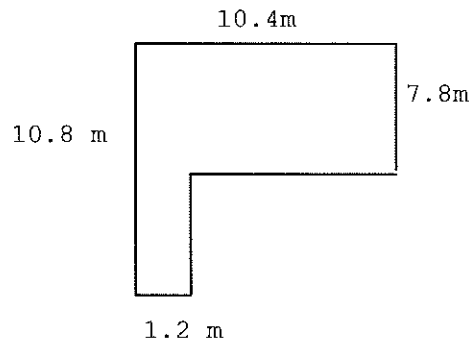
Marks

Question 26 (15 marks) Use a SEPARATE writing booklet.

(a) Fully simplify $3x - 4(x + 5) + 2$

1

(b) The Williams family have a new outdoor patio. The diagram below shows a plan of the patio.



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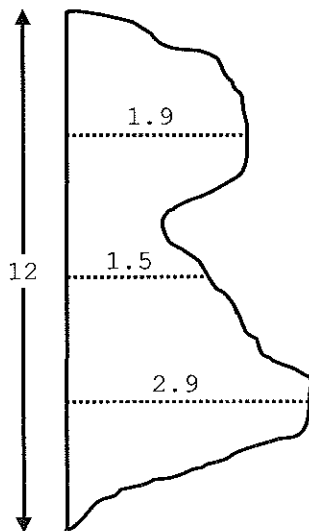
(i) The patio is to be painted. Calculate the area to be painted.

2

(ii) The paint costs \$21.50 for a 1 litre tin and \$56.35 for a 4 litre tin. Given that 4 litres of paint is enough to cover an area of 15 m^2 , what is the minimum cost of the paint required to paint the patio?

2

(c) Measurements were taken every 3 km apart across the area of a rural community, as shown below:



(i) Using two applications of Simpson's Rule, approximate the area of this community to the nearest km^2

3

(ii) Find the area in hectares.

1

(iii) If 1 253 people lived in the community, what was the population density per km^2 ?

1

Question 26 continued on next page

Question 26 (continued)

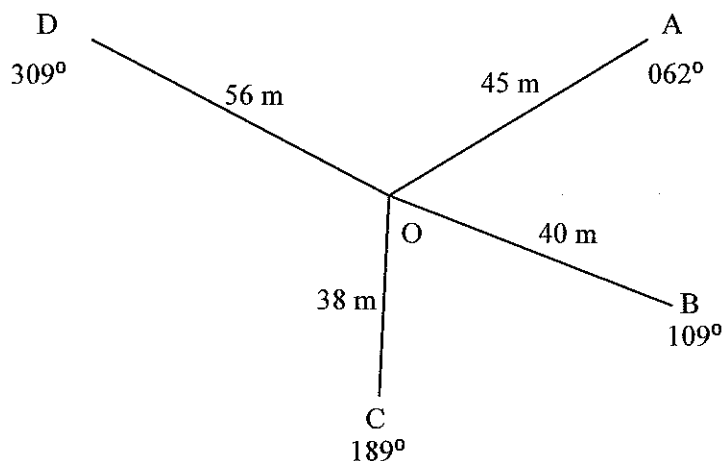
Marks

- (d) A courier company purchased a delivery van in December 2009 for \$80 000. In December each year, beginning in 2010, the value of the van depreciates by 12% using the declining balance method.
- (i) What will the van's value be in December 2014? 1
 - (ii) If the accountant used straight-line depreciation, how much less would the van's value be in December 2014? 2
 - (iii) Explain why straight-line depreciation would reduce the value of the van so much more in the same period of time. 2

End of Question 26

Question 27 (15 marks) Use a SEPARATE writing booklet.

- (a) The following sketch was made during a radial survey of a field.



- (i) What is the size of $\angle BOC$? 1
 - (ii) Calculate the area of $\triangle BOC$ correct to the nearest square metre. 2
 - (iii) Find the distance from B to C. (Round to 2 decimal places). 2
- (b) Bella buys 800 shares in Nu-nail cosmetics. The shares were trading at \$13.54 per share. The brokerage fee for purchasing the shares was 3% of the purchase price.
- (i) Nu-nail declared an annual dividend yield of 5.5%. How much did Bella receive? 1
 - (ii) Bella sells her shares for \$15.60 per share and pays \$200 brokerage on the sale. What net profit does she make from the shares? 2

Question 27 continued on next page

Question 27 (continued)

Marks

- (c) Karen needs to borrow \$26 500 to buy a car. She wants to repay the loan over a period of 10 years. XYZ Finance have offered her an interest rate of 5.5% per annum.

XYZ Finance Monthly Repayment Amounts per \$1000 borrowed				
Interest Rate (p.a.)	Term of Loan (years)			
	5	10	15	20
5.0%	18.87	10.61	7.91	6.60
5.5%	19.10	10.85	8.17	6.88
6.0%	19.33	11.10	8.44	7.16
6.5%	19.57	11.35	8.71	7.46

- (i) Use the table above to calculate Karen's monthly repayment if she borrows the money from XYZ Finance.

1

- (ii) What is the total amount Karen will pay for her car?

1

Karen sees an advertisement for a cheaper loan. The competitor's interest rate is 4.8% per annum.

- (iii) *Calculate* Karen's monthly repayments if she chooses this cheaper loan and still repays it in 10 years.

2

- (iv) How much interest will Karen save over the term of the loan if she chooses the cheaper loan?

2

- (d) The scale on a map is 1:150 000. The distance between Bognor and Clacton on the map is 5.7 cm. What is the actual distance between Bognor and Clacton in kilometres?

1

End of Question 27

Question 28 (15 marks) Start a new sheet of paper.

- (a) After the recent drought the rain gauge at the Wiley Farm registered 62.2 mm of rain during a storm. The machinery shed has a roof that measures 25 metres by 10 metres.

- (i) The rain that falls on the roof of the machinery shed is collected into a cylindrical tank. Show that 15 550 litres of rain water will be collected during the storm. (Answer to the nearest litre)

2

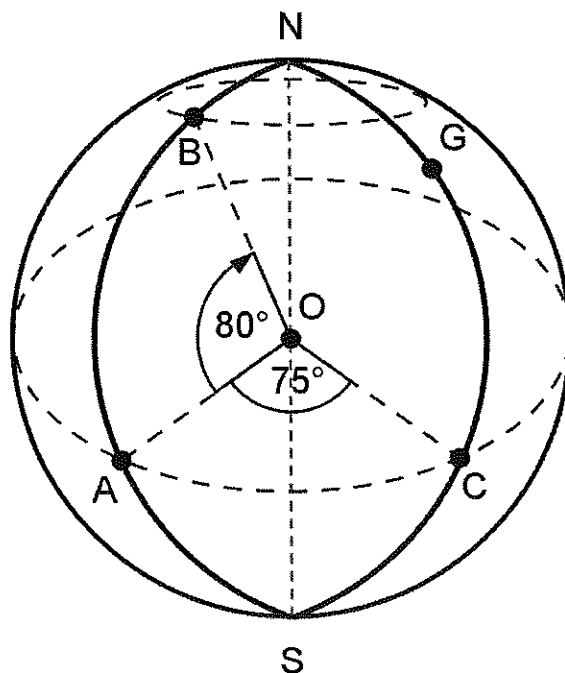
- (ii) If the cylindrical tank has a diameter of 6 metres, what depth of water was in the tank after the storm (assuming the tank was empty before the storm)? Answer correct to two decimal places.

2

Question 28 continued on next page

Question 28 (continued)

(b)



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In the diagram of the Earth, O represents the centre and G represents Greenwich. The points A and C lie on the equator.

$$\angle AOC = 75^\circ \text{ and } \angle AOB = 80^\circ$$

- (i) What is the latitude of point B? 1
- (ii) Given that the approximate radius of the Earth is 6 400 km, calculate the distance from point A to point C, giving your answer correct to the nearest kilometre. 2
- (iii) Given that 1 nautical mile is approximately equal to 1.852 km, calculate the time a ship would take to travel from point A to point B, if it is travelling at an average speed of 17 knots. 2
- (c) The environment committee at a school is building a garden which is to contain 3 plants. Donations from a local nursery have left them with seeds for 5 varieties of native plant, 3 different flowering plants and 4 types of fruit-bearing plants.
- They have decided to select 1 native plant, 1 flowering plant and 1 fruit-bearing plant. How many different combinations can they select for their garden? 1
- (d) Solve the equation $\frac{-3(4+x)}{2} = 9$ to find the value of x . 2

Question 28 continues on page

Question 28 (continued)

Marks

(e) Upon winning a lottery prize, Jim was offered his choice of the following two prizes:

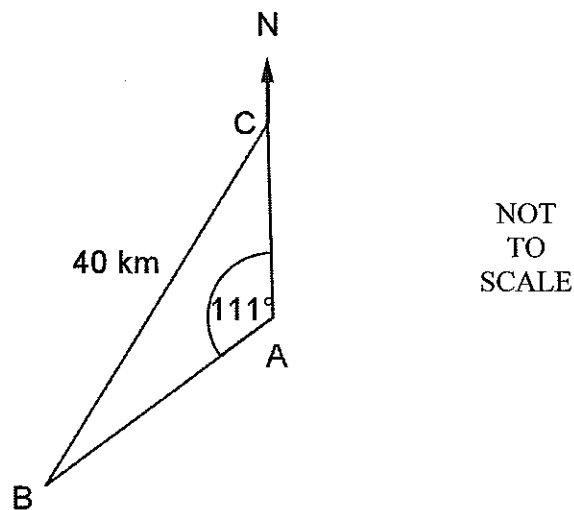
<p>Prize 1 An annuity of \$500 per year for 10 years earning 5% per annum. No withdrawals may be made until the end of the 10 years.</p>	<p>Prize 2 A lump sum of \$5 000 paid immediately.</p>
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- (i) Calculate the future value of Prize 1. 1
- (ii) How much should the lump sum in Prize 2 be if it is to be equivalent in value to Prize 1 (if it is also invested at 5% p.a. for 10 years)? 2

End of Question 28

Question 29 (15 marks) Start a new sheet of paper.

(a)



In the diagram above, C is due North of A , $\angle BAC = 111^\circ$ and the distance from B to C is 40 km.

- (i) Given that the bearing of C from B is $037^\circ T$, show that $\angle ABC = 32^\circ$. 2
- (ii) Calculate the distance from A to C to the nearest kilometre. 2
- (b) For the equation: $200 = 10 \times 1.12^n$, by using guess and check, determine the value of n correct to 1 decimal place. 2

Question 29 is continued on next page

Question 29 (continued)

Marks

- (c) One hundred new cars were tested to see how many defects occurred during the manufacturing process. The results are in the frequency table below:

Number of Defects	Frequency
0	2
1	7
2	24
3	31
4	20
5	12
6	4

- (i) Calculate the mean number of defects found. 1
- (ii) Calculate the standard deviation for this sample.
(Give your answer correct to 2 decimal places.) 1
- (iii) In a sample of 500 cars, how many cars would you expect to have more than 3 defects? 1
- (d) Madison is paid a salary of \$46 800, and has \$480 per fortnight deducted from her pay in PAYG tax instalments.
- (i) What is her fortnightly net pay? 1
- (ii) She also has investments which earned her \$480.00 in the financial year and has tax deductions which total \$1 500.

What is her taxable income? 1
- (iii) She pays income tax on this taxable income calculated according to the table below, plus a Medicare levy of 1.5% of her taxable income. Calculate her tax due for the financial year?
- | <i>Taxable income</i> | <i>Tax payable</i> |
|-----------------------|---|
| \$0 – \$12 000 | Nil |
| \$12 001 – \$30 000 | Nil plus 30 cents for each \$1 over \$12 000 |
| \$30 001 – \$45 000 | \$5400 plus 40 cents for each \$1 over \$30 000 |
| \$45 001 – \$60 000 | \$11 400 plus 50 cents for each \$1 over \$45 000 |
| over \$60 000 | \$18 900 plus 55 cents for each \$1 over \$60 000 |
- (iv) Will Madison receive a tax refund or tax bill for the financial year.
Support your answer with calculations. 3

1

End of Question 29

Question 30 (15 marks) Start a new sheet of paper.

- (a) The length of a pole is measured as 45 cm to the nearest centimetre. What is the percentage error of this measurement? (Answer correct to 2 significant figures).

2

- (b) Ebony has a credit card with no interest free period and an interest rate of 14% p.a. calculated daily. She had paid her card off in full before July and makes the following purchases during the month of July.

2 nd July	Cookpot	\$ 68.00
16 th July	DVDs	\$ 53.50
23 rd July	Petrol	\$ 40.00
26 th July	Makeup	\$ 105.50
29 th July	Dress	\$ 150.80

Ebony pays her credit card bill in full on the 5th of August. How much interest does she pay?

2

- (c) Rosie takes out a home loan of \$120 000 at 6% p.a. Interest (I) is calculated monthly. She will make a repayment (R) of \$1250 each month. Rosie draws up a table showing the progress she makes in repaying the loan over the first 5 months.

Months	Principal (P)	Interest (I)	$P + I$	$P + I - R$
1	120 000.00	600.00	120 600.00	119 350.00
2	119 350.00	596.75	119 946.75	118 696.75
3	118 696.75	593.48	119 290.23	118 040.23
4	118 040.23	590.20	118 630.43	117 380.43
5	A	B		C

- (i) What is the monthly interest rate?

1

- (ii) Calculate the values of A, B and C.

3

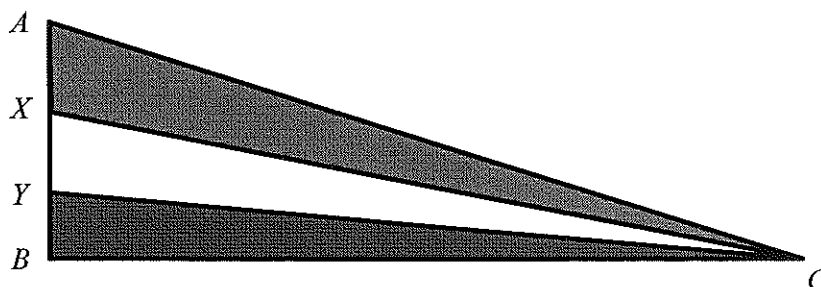
- (iii) By what percentage had Rosie reduced the principal of the loan at the end of 5 months? (correct to 1 decimal place).

1

Question 30 is continued on next page

Question 30 (continued)

- (d) The triangular banner shown is in three sections. The triangle ABC is right angled with $BC = 120$ cm and $AB = 45$ cm. The distances AX , XY and YB are equal and $\angle XYC = 95^\circ$.



- (i) Find the distance YC correct to 3 significant figures. 1
- (ii) Hence find the area of the triangle XYC . 2
- (iii) What percentage of the area of the banner is the triangle XYC . 1

- (e) Given that the formula for the amount owed on a loan is calculated using the formula:

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

where A_n = Amount still owing, P = Amount of the loan, M = monthly repayment, n = number of repayments and r = monthly interest rate as a decimal.

For a loan of \$420 000 at an interest rate of 5.9% p.a. reducible over a period of 20 years, calculate the monthly repayment M , payable at the end of each month (assuming interest is compounded monthly).

2

End of Paper