



Student Name: _____

Student Number: _____

Pre-Trial 2015

General Mathematics

General Instructions

- Reading time – 5 minutes
- Working time – 2½ hours
- Write using black or blue pen
- Board approved calculators may be used
- A multiple choice answer sheet is provided at the back of this paper
- A formula sheet is provided

Total Marks – 100

Section I

25 marks

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

Section II

75 marks

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

Section I

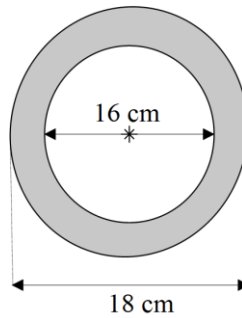
25 marks

Attempt Questions 1 – 25.

Allow about 35 minutes for this section

Use the multiple-choice answer sheet for Questions 1 – 25

1. Which expression could be used to find the shaded area below?



- (A) $\pi(9-8)$
- (B) $\pi(9^2-8^2)$
- (C) $\pi(18-16)$
- (D) $\pi(18^2-16^2)$

2. Mason borrows \$10 000 at 6% p.a. to buy a car and chooses to repay it in monthly repayments over 5 years. The table below shows the monthly repayment schedule.

Find how much he will pay for the car altogether.

Monthly Repayments on a loan of \$10 000

Time (years)

Rate (% p.a.)		2	3	4	5	6	7	8
	4	\$434.25	\$295.24	\$225.79	\$184.17	\$156.45	\$136.69	\$121.89
	5	\$438.71	\$299.71	\$230.29	\$188.71	\$161.05	\$141.34	\$126.60
	6	\$443.21	\$304.22	\$234.85	\$193.33	\$165.73	\$146.09	\$131.41
	7	\$447.73	\$308.77	\$239.46	\$198.01	\$170.49	\$150.93	\$136.34
	8	\$452.27	\$313.36	\$244.13	\$202.76	\$175.33	\$155.86	\$141.37

- (A) \$193.33
- (B) \$966.65
- (C) \$1599.80
- (D) \$11599.80

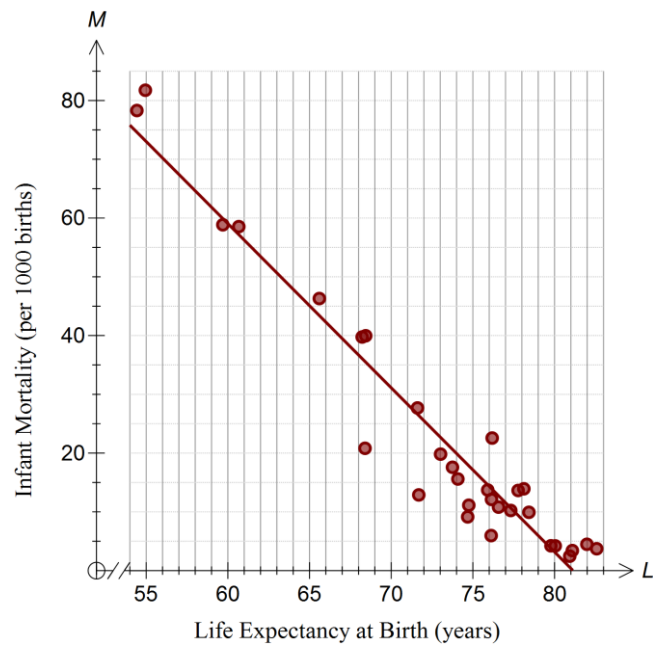
3. Mohsen has three spare tickets to an opera performance. He texts TEN friends on his phone who like opera and offers a ticket each to the first THREE who text him back.

How many different combinations of three friends could get the tickets?

- (A) 120
- (B) 240
- (C) 360
- (D) 720

4. Josh researches the life expectancy at birth and the infant mortality rate for a number of countries. He then draws a scatterplot with a line of best fit.

What is the likely correlation coefficient for this data?



- (A) -0.08
- (B) -0.82
- (C) 0.59
- (D) 0.95

5. Austin has a laptop which has an internal hard drive with a capacity of 1280 megabytes. He buys an external hard drive with capacity of 12.5 gigabytes to back up his laptop.

Which of the following statements is true?

- (A) The external drive does not have enough capacity to back up his laptop.
- (B) The external drive has twice the capacity needed to back up his laptop.
- (C) The external drive has five times the capacity needed to back up his laptop.
- (D) The external drive has ten times the capacity needed to back up his laptop.

6. Sebastian buys shares in a company for \$0.73 per share. The company pays a dividend of \$0.13 per share. What is the dividend yield?

- (A) 0.13%
- (B) 5.62%
- (C) 17.81%
- (D) 21.67%

7. Expand and simplify the expression $3ab - 3a(2a - 4b) - a^2$.

- (A) $5a^2 - 9ab$.
- (B) $7a^2 - 15ab$.
- (C) $9ab - 5a^2$.
- (D) $15ab - 7a^2$.

8. A group of 150 workers took a competency test in welding and their results were normally distributed. The mean score of the group was 90% with a standard deviation of 5%.

Peter scored 85% on the test. What is this as a z-score?

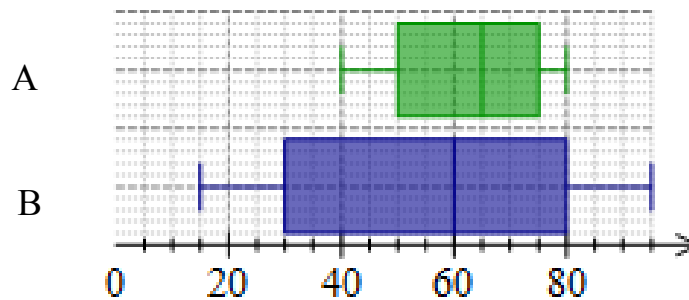
- (A) -2
- (B) -1
- (C) 1
- (D) 2

9. Given the following formula $p = 2\pi(r + \frac{s}{2}) \times q$

Calculate the value of q , when $r = 20$, $s = 30$ and $p = 55$

- (A) 0.25
- (B) 0.5
- (C) 5
- (D) 45

10. Two examinations results are displayed in the box plot. What is the interquartile range for exam B?

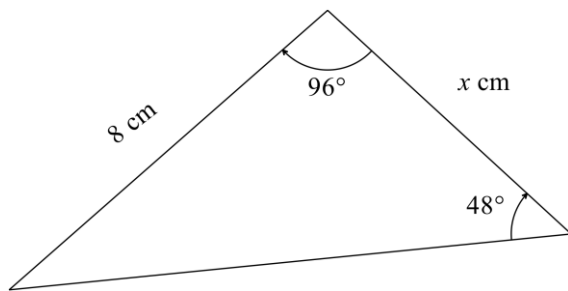


- (A) 25
- (B) 40
- (C) 50
- (D) 80

11. Handicloth is a brand of kitchen cloth which is sold in various sizes and has been tested to absorb liquid at a rate of 5 L/m^2 . How much liquid could a 30 cm square Handicloth absorb?

- (A) 15 mL
- (B) 150 mL
- (C) 1.5 L
- (D) 15 L

12. The correct solution to find the unknown side:



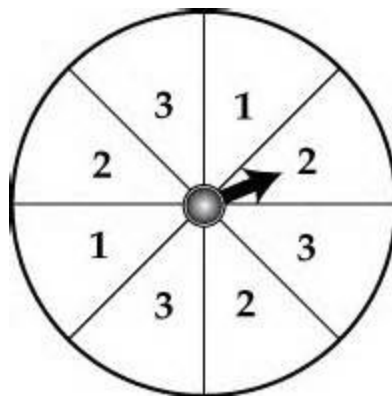
(A) $x = \frac{8 \sin 96}{\sin 48}$

(B) $x = \frac{8 \sin 36}{\sin 48}$

(C) $x = \frac{8 \sin 48}{\sin 36}$

(D) $x = \frac{8 \sin 96}{\sin 48}$

13. James uses the spinner for a game. What is the simplified probability of landing on “1”?



(A) $\frac{1}{8}$

(B) $\frac{2}{8}$

(C) $\frac{3}{8}$

(D) $\frac{1}{4}$

14. What is the area of ABCD using the field book entry

$$\begin{array}{c} \text{D} \\ \left| \begin{array}{c} 40 \\ 30 \\ 10 \\ 0 \end{array} \right| 10 \quad \text{C} \\ \text{B} \quad 20 \quad \left| \begin{array}{c} 40 \\ 30 \\ 10 \\ 0 \end{array} \right| \\ \text{A} \end{array}$$

- (A) 40
- (B) 450
- (C) 600
- (D) 1200

15. In a game involving two dice, what is the probability of rolling the same number on both dice?

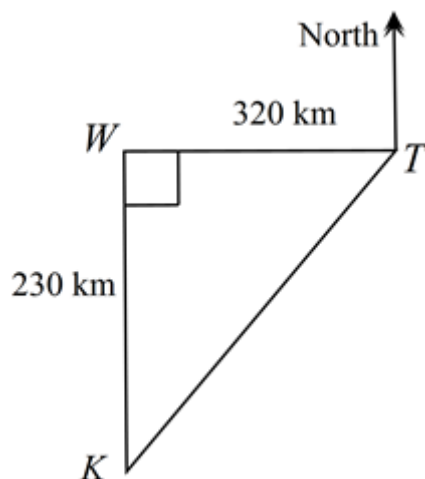
- (A) $\frac{1}{6}$
- (B) $\frac{1}{2}$
- (C) $\frac{1}{36}$
- (D) $\frac{12}{36}$

16. Brigit sells perfume and receives wages of \$1 250 per month plus 4% commission on all her sales.
What are her sales in one month if she receives a total pay of \$1 302?

- (A) \$52.00
- (B) \$1297.92
- (C) \$1300.00
- (D) \$1406.08

17. A plane flies due north from Kensington (K) for 230 km to Wishire (W). It then turns and flies due east for a distance of 320 km to Trenton (T).

What is the bearing of Kensington from Trenton?



- (A) 036°
- (B) 216°
- (C) 234°
- (D) 306°

18. Rebecca invests \$1450 in an account for 1 year, which pays 12% p.a. interest, compounding quarterly. At the end of her investment, she adds a further \$1280 to the account.

What is her final balance?

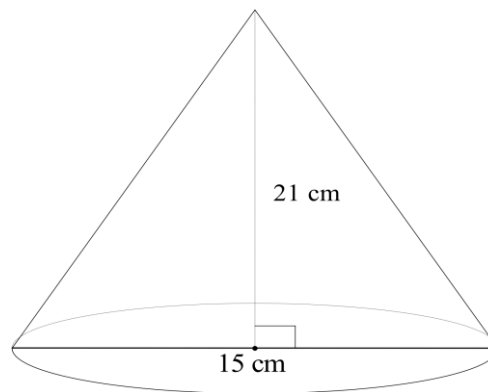
- (A) \$3252.48
- (B) \$2 911.99
- (C) \$3 277.47
- (D) \$5 604.25

19. Nola's car has a fuel consumption rate of 15 litres/100 km on city roads and 10 litres/100 km on the open highway.

How much fuel will she use in a trip which has 50 km of city driving and 250 km of driving on the open highway?

- (A) 7.5 litres
- (B) 25.0 litres
- (C) 32.5 litres
- (D) 50.0 litres

20. The volume of the following cone is closest to:



- (A) 1237 cm^3
- (B) 3711 cm^3
- (C) 4948 cm^3
- (D) 14844 cm^3

21. A sphere has a surface area of 210 cm^2 . Calculate the length of its radius correct to two decimal places.

- (A) 4.08 cm
- (B) 4.09 cm
- (C) 7.08 cm
- (D) 16.71cm

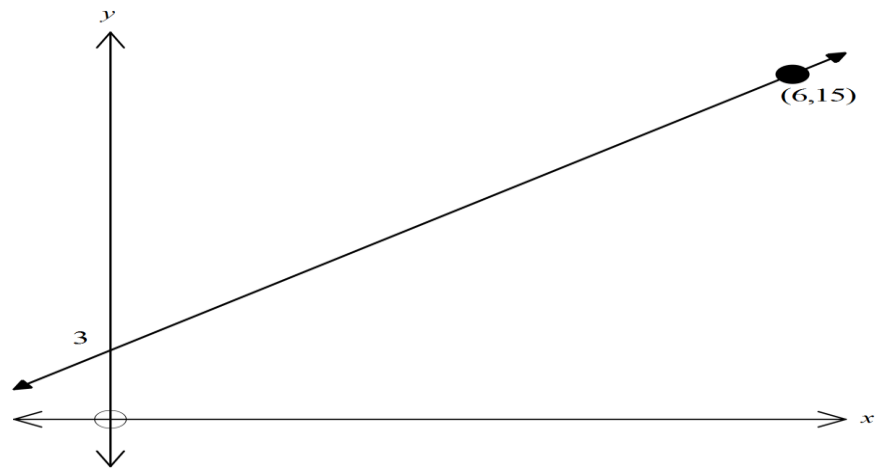
22. Sam is working as a nurse on a children's ward. He uses Young's formula to calculate an 8 year old child's dose of Adamine.

$$\text{Young's Formula: Dosage for child 1-12} = \frac{\text{age of child (in years)} \times \text{adult dose}}{\text{age of child (in years)} + 12}$$

Given the adult dosage of Adamine is 15 mL, what is the child's dose?

- (A) 1.5 mL
- (B) 3 mL
- (C) 6 mL
- (D) 12 mL

23. This line is best represented by which equation?



- (A) $y = 2x + 3$
- (B) $y = 3x + 2$
- (C) $y = 6x + 3$
- (D) $y = 6x + 15$

24. Lauren holds a survey of the residents of her block of units. She recorded some of the results in the two way table below:

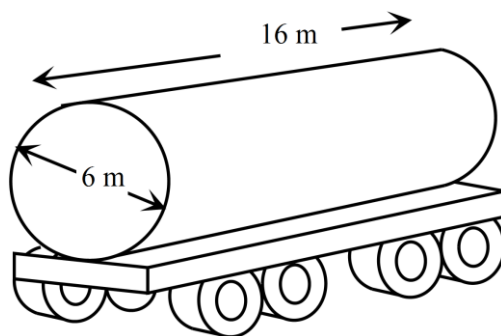
	Male	Female	Total
Problems to report.	16	24	
No Problems to report.	35	25	
Total			

If a female resident was chosen at random, what is the probability that she had no problems?

- (A) $\frac{6}{25}$
- (B) $\frac{1}{4}$
- (C) $\frac{24}{49}$
- (D) $\frac{25}{49}$

25. A water delivery truck has a cylindrical tank with the dimensions shown, on a trailer.

How many 150 kilolitre house tanks could be filled by the cylindrical tank on the trailer?



- (A) 3 tanks
- (B) 6 tanks
- (C) 9 tanks
- (D) 30 tanks

Section II

75 marks

Attempt Questions 26 - 30

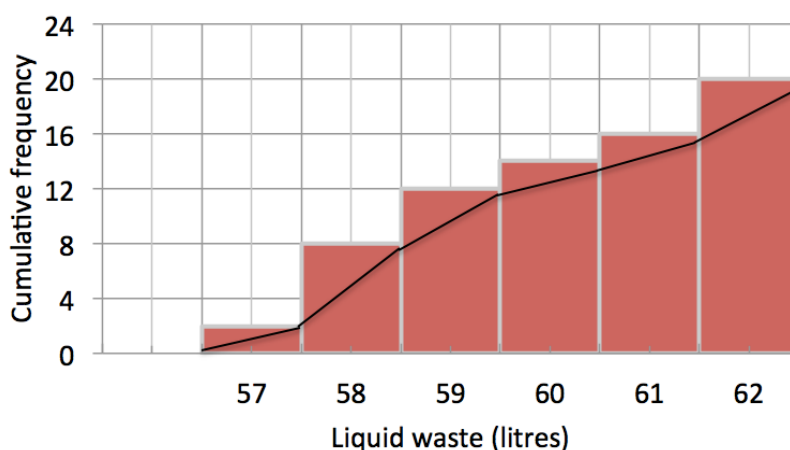
Allow about 115 minutes for this section

Answer each question in the space provided

In Questions 26 – 30, your responses should include relevant mathematical reasoning and/or calculations.

Question 26 (15 marks)

- (a) The cumulative frequency graph below shows the contents (in litres) of all the containers of liquid waste found on a building site.



- (i) How many containers were found on the building site? **1**

- (ii) What was the median amount of liquid found in the containers? **1**

Question 26 continues on the next pag

- (b) Tracy measures her mass as being 45 kg. On Saturday night she had 4 standard drinks in 2½ hours.

(i) Calculate her BAC and show that is more than 0.08

1

- (ii) When Tracy has a BAC is greater than 0.08, her braking reaction time whilst driving increases by 20%. However her normal reaction time, when unaffected by alcohol in a braking test was 0.9 seconds.

What would her reaction time have been in a braking test *after* drinking on Saturday night? 1

- (iii) If she were driving a car travelling at 25 m/s, how many metres *further* would the car have travelled because of her slower reaction time? 1

- (c) Petra works in a car yard, where she spends some time doing clerical work and she also acts as a salesperson. She is paid \$21.50 per hour for the time she spends working at the car yard plus a commission of 6% of any sales that she generates.

Last week she worked for 35 hours and generated sales to the value of \$18 000.

(i) What was her gross pay last week?

2

Question 26 continues on the next page

- (ii) Last financial year Chelsea earned a taxable income of \$72 480. Use the table below to calculate the income tax due for the year.

1

Taxable income	Tax on this income
0 – \$18,200	Nil
\$18,201 – \$37,000	19c for each \$1 over \$18,200
\$37,001 – \$80,000	\$3,572 plus 32.5c for each \$1 over \$37,000
\$80,001 – \$180,000	\$17,547 plus 37c for each \$1 over \$80,000
\$180,001 and over	\$54,547 plus 45c for each \$1 over \$180,000

Question 26 continues on the next page

- (d) Data was collected from 30 students on the number of text messages they had sent in the previous 24 hours. The set of data collected is displayed.

<i>Male</i>		<i>Female</i>
9 9 8 7 6 5 5 4 2 1	0	8 9
1 1 0 0	1	1 1 2 5 6 8 8 8
0	2	0 1 7
	3	4
	4	
	5	
	6	
1	7	

- (i) What is the sample standard deviation of the data collected from the female students? **1**

- (ii) What is the interquartile range of the data collected from the female students? **2**

- (e) Three digits are randomly chosen from 3, 7, 2, 8, and 4 to make a three digit number. Digits can be repeated. For example, the numbers 363 or 222.

- (i) How many different 3 digit numbers can be made? **1**

- (ii) What is the probability that this number is odd? **1**

Question 26 continues on the next page

- (f) Two bags each contain yellow and green counters. Bag A contains 2 yellow and 3 green counters. Bag B contains 1 yellow and 4 green counters. One counter is chosen from each bag.

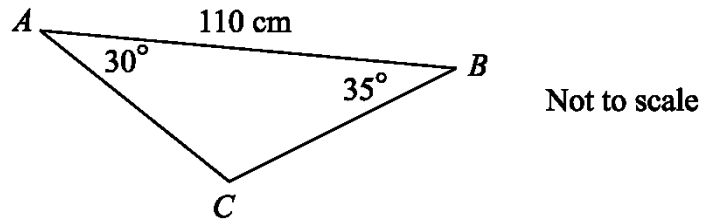
- (i) What is the probability of drawing two yellow counters? 1

- (ii) What is the probability of drawing a yellow and green counter? 1

End of Question 26

Question 27 (15 marks)

- (a) $\triangle ABC$ has $\angle ABC = 35^\circ$ and $\angle CAB = 30^\circ$. The length of AB is 110 cm.



What is the length of BC , correct to one decimal place?

2

- (b) A freshwater lake contains mainly herrings and catfish. To estimate their numbers, a trawl was done of the lake, which produced 62 herring and 24 catfish.

These were all tagged and released and a month later, another trawl was done which captured 80 herrings of which 6 were tagged and 32 catfish of which 2 were tagged.

How many of the two species would you estimate were in the lake?

2

Question 27 continues on the next page

(c) Solve the following equation $2x - 3 = 2 - 3(x - 1) + 3x$

2

(d) Solve the following pair of simultaneous equations.

2

$$2x + y = 12$$

$$5x - y = 2$$

Question 27 continues on the next page

(e) The marks in a class test are normally distributed. The mean is 100 and the standard deviation is 10.

(i) Paul's mark is 115. What is his z-score? 1

(ii) Trish has a z-score of 0. What mark did she achieve in the test? 1

(iii) What percentage of marks lie between 80 and 110? 1

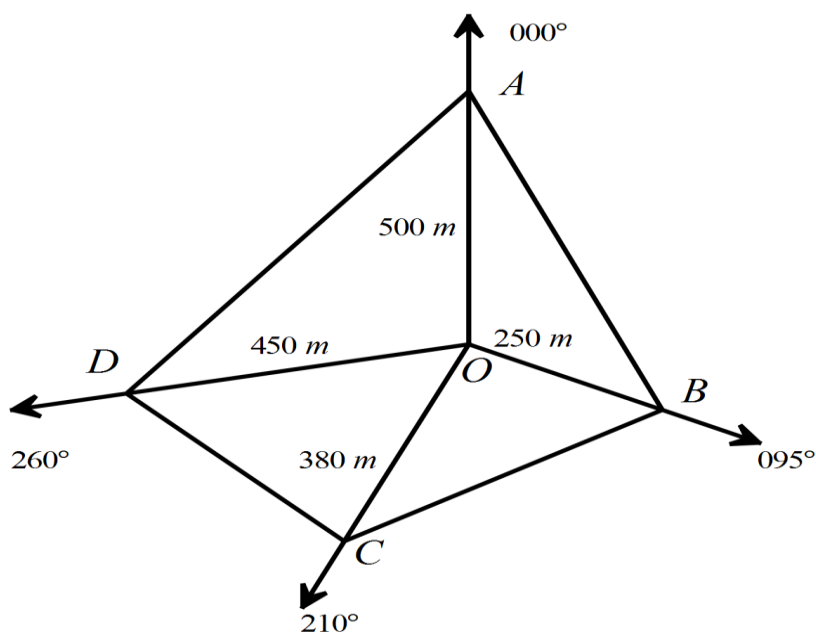
(f) Ted scored the following number of goals in his 10 most recent games:

16, 16, 15, 16, 15, 14, 14, 12, 17, 15.

What number of goals does Ted need to score in the next game for the mean of his scores to be 16? 1

Question 27 continues on the next page

- (g) Ryan completes a radial survey of a field $ABCD$, from a central point O . The measurements that he takes are shown on the diagram below.



- (i) Calculate the area of the triangular section AOB , to the nearest m^2 .

1

- (ii) Calculate the length of the boundary BC , to the nearest m .

2

End of Question 27

Question 28 (15 marks)

- (a) Gabi and Toby borrowed \$465 000 at 8% p.a. reducible interest. The interest is charged monthly and the monthly repayment is \$3550. The table shows the amounts owing during the first three months

Months	Principal	Interest	$P + I$	$P + I - R$
1	\$465 000	\$3100	\$468 100	\$464 550
2		\$3097	\$467 647	
3	\$464 097			

- (i) What is the principal at the beginning of the second month? 1

- (ii) How much is owed at the end of the second month? 1

- (iii) Calculate the interest to be paid at the beginning of the third month? 1

Question 28 continues on the next page

- (b) A microdrip IV pump that delivers 60 drops/mL is used to administer medications and fluids. It requires a drip rate in drops per minute (dpm) to be set.

The formula below is used to calculate the drip rate:

$$\text{Drip rate} = \frac{\text{volume(mL)} \times \text{drops/mL}}{\text{time in minutes}}$$

- (i) A patient requires 1200 mL of fluid to be given intravenously over 10 hours. Calculate the drip rate?

1

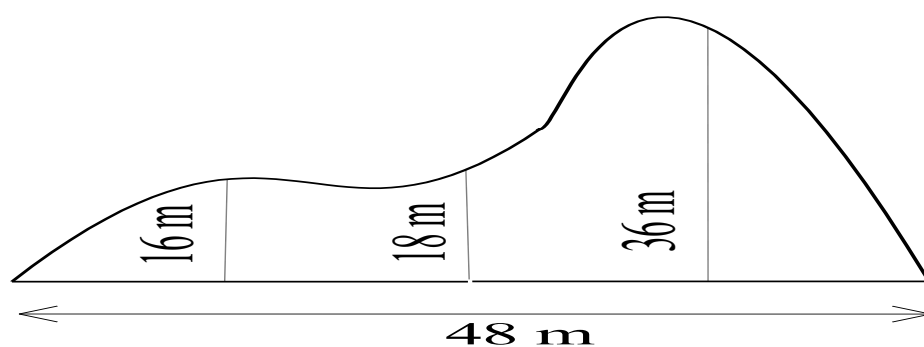
- (ii) Jason is working on a ward and notices the drip rate on a patient's microdrip IV is set to 75 dpm. The IV has a volume of 900 mL.

How long should this IV run?

2

Question 28 continues on the next page

(c) The area of a field is shown below. All measurements are metres.



Use two applications of Simpson's rule to approximate the area of the field.

2

Question 28 continues on the next page

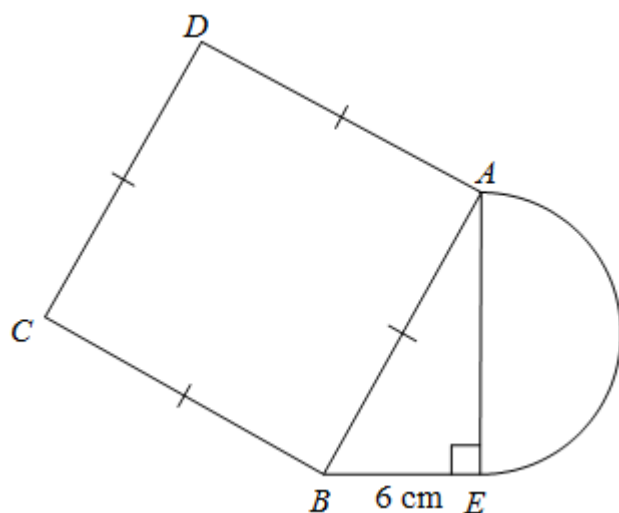
- (d) James rolls a die. If he rolls a 5 he wins \$15, but if he rolls an even number he loses \$2. What is his financial expectation?

- (e) Out of 220 families that have 3 children, how many would you expect to have their eldest child be a girl?

[illegible]

Question 28 continues on the next page

- (f) A piece of aluminium consists of a semicircle, a right triangle and a square. The radius of the semicircle is 4 cm and $BE = 6$ cm.



- (i) What is the length of AE ? 1

- (ii) Calculate $\angle ABE$. Answer to the nearest degree. 1

- (iii) Show that the length of AB is 10 cm. 1

Question 28 (e) continues on next page

(iv) Calculate the total area of this piece of aluminium.

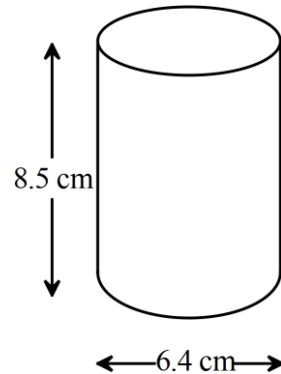
Answer correct to the nearest square centimetre.

2

End of Question 28

Question 29 (15 marks)

- (a) A machine on a production line produces solid metal cylindrical parts. The design specifies a diameter of 6.4 cm and a height of 8.5 cm.



- (i) Calculate the surface area of the cylinder, correct to one decimal place.

1

- (ii) Cylinders that come off the production line have diameters are normally distributed with a mean of 6.3 cm and a standard deviation of 0.05 cm.

Any cylinders with a diameter greater than 6.4 cm or less than 6.25 cm must be rejected.

What percentages of the cylinders are rejected?

2

Question 29 continues on the next page

- (b) The table shows present value interest factors for some monthly interest rates (r) and loan terms in months (N).

		Monthly Interest Rate (r)						
Term in months (N)		0.4%	0.45%	0.5%	0.55%	0.6%	0.65%	0.7%
	112	90.1310	87.8238	85.5987	83.4522	81.3812	79.3827	77.4536
	113	90.7680	88.4259	86.1678	83.9903	81.8899	79.8636	77.9082
	114	91.4023	89.0253	86.7342	84.5254	82.3955	80.3413	78.3597
	115	92.0342	89.6220	87.2977	85.0576	82.8981	80.8160	78.8081
	116	92.6636	90.2160	87.8584	85.5868	83.3977	81.2877	79.2533
	117	93.2904	90.8074	88.4163	86.1132	83.8944	81.7562	79.6954
	118	93.9147	91.3961	88.9714	86.6367	84.3880	82.2218	80.1345
	119	94.5366	91.9822	89.5238	87.1573	84.8788	82.6844	80.5705
	120	95.1560	92.5656	90.0735	87.6751	85.3666	83.1439	81.0035
	121	95.7729	93.1465	90.6204	88.1901	85.8515	83.6005	81.4334
	122	96.3873	93.7247	91.1645	88.7022	86.3335	84.0542	81.8604

Ruby borrows \$6500 for home improvements. She repays the loan with monthly repayments over 10 years. She is charged 6% p.a. interest.

- (i) Calculate the amount of her monthly instalment.

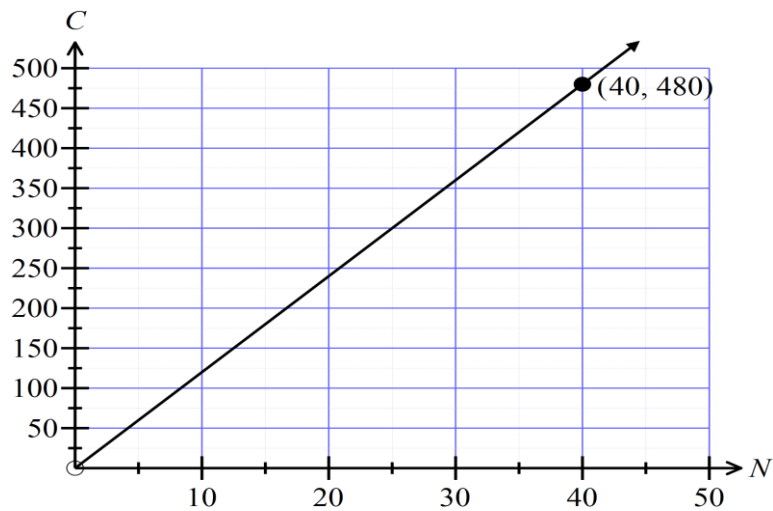
1

- (ii) How much less interest would she pay if she took the loan over 9.5 years instead of 10 years?

2

Question 29 continues on the next page

- (c) Ebony is the manager of a company that produces widgets. She draws the graph of the line, which gives the income (C) from selling (N) widgets.



What is the equation of the line?

1

- (d) Coffs Harbour in New South Wales is located at $(30^\circ\text{S}, 153^\circ\text{E})$ and Springbok in South Africa is located at $(30^\circ\text{S}, 18^\circ\text{E})$.

- (i) What is the time difference between these places?

1

- (ii) What is the time and day in Springbok if it is Tuesday 3 a.m at Coffs Harbour? (Ignore time zones).

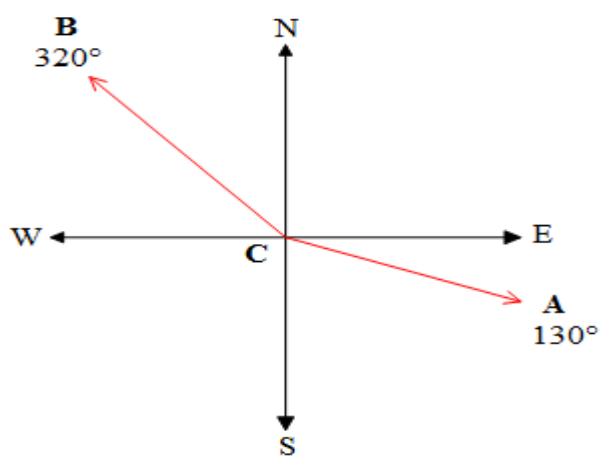
1

Question 29 continues on the next page

(e) Ship A and B leave port C at 10.00 am in different directions.

Ship	Bearing from C	Speed
A	130°	40 km/h
B	320°	25 km/h

The diagram below shows the courses of each of the ships from port C .



- (i) Calculate the distance travelled by each ship by 2.00 pm. 1

- (ii) What is the size of $\angle ACB$? 1

Question 29 (e) continues on the next page

- (iii) What is the distance AB between the ships at 2.00 pm?
Answer correct to the nearest kilometre.

2

- (e) Nancy buys a car which has a market value of \$72 000 before on-road costs.

Stamp duty on the car is calculated at these rates:

- 3.5% of the market value up to and including \$45,000
- 5% of the market value over \$45,000.

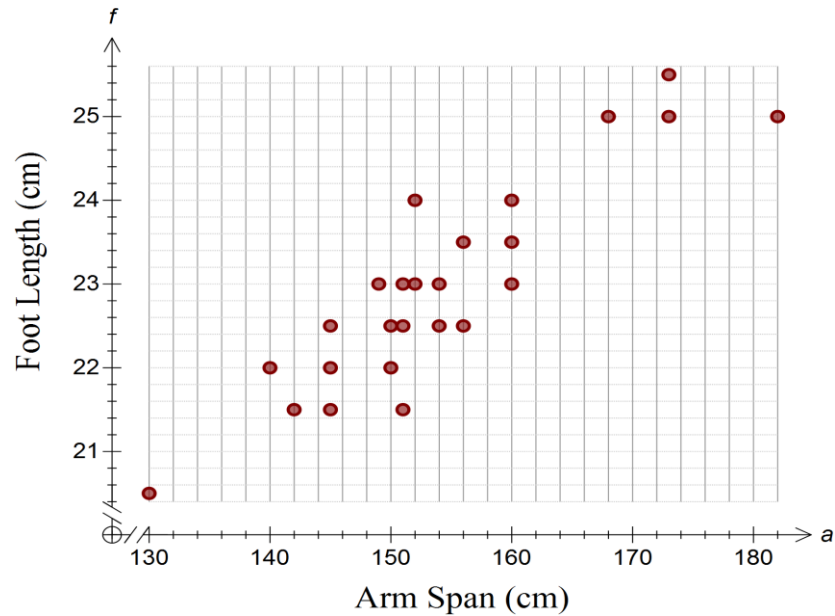
Calculate the stamp duty payable on the purchase of the car.

2

End of Question 29

Question 30 (15 marks)

- (a) James collects data from a sample of students in all years of her school. She draws the scatterplot below using the data she collected on arm span and foot length.



James uses a statistics software package to calculate the correlation coefficient and gets a value of 0.9.

Explain what this result tells you about arm span and foot length.

1

Question 30 continues on the next page

- (b) The statistics package also gives the results below for the mean and standard deviation of the two quantities.

	Arm Span (a)	Foot Length (f)
Mean	154.0	23.0
SD	11.3	1.3

- (i) Use the above information to show that the gradient of the least-squares line of best fit is approximately 0.1, correct to 1 decimal place.

2

- (ii) Use the information above to calculate the intercept of the least-squares line of best fit on the f axis, correct to 1 decimal place.

2

- (iii) Using the variables a and f , write down the equation of the least-squares line of best fit.

Use it to estimate the foot length of a student whose arm span was 170 cm.

2

Question 30 continues on the next page

- (c) Jimmy analyses the retention rate, which is the percentage of information recalled at the next lesson for classes at the local community college. Lessons are one hour OR half hour in length and are held in the morning, afternoon or evening.

The table shows a summary of his results:

Length of Lesson		Time of Day		
		Afternoon	Evening	Morning
Half-Hour	Mean of Retention Rate	51%	43%	
	Standard Deviation of Retention Rate	10%	15%	
Hour	Mean of Retention Rate	65%	62%	73%
	Standard Deviation of Retention Rate	7%	10%	11%

- (i) The mean and standard deviation for the morning half hour class is missing.
The raw data for the 8 students in the morning half-hour class is given below:

35% 55% 45% 40% 65% 40% 40% 50%

Find the mean and standard deviation for this class.

2

- (ii) Which class had the greatest variability i.e. spread, in their retention rates?

1

Question 30 continues on the next page

(d) The table below gives the future value interest factors for a range of loan terms and interest rates.

Table of future value interest factors									
	Interest Rate per Period								
Periods	0.35%	0.40%	0.45%	0.50%	0.55%	0.60%	0.65%	0.70%	0.75%
116	142.78	147.23	151.87	156.69	161.70	166.92	172.35	178.00	183.89
117	144.28	148.82	153.55	158.47	163.59	168.92	174.47	180.25	186.26
118	145.78	150.42	155.24	160.26	165.49	170.93	176.60	182.51	188.66
119	147.29	152.02	156.94	162.06	167.40	172.96	178.75	184.79	191.08
120	148.81	153.63	158.65	163.87	169.32	175.00	180.91	187.08	193.51
121	150.33	155.24	160.36	165.69	171.25	177.05	183.09	189.39	195.96
122	151.86	156.86	162.08	167.52	173.19	179.11	185.28	191.72	198.43
123	153.39	158.49	163.81	169.36	175.15	181.19	187.48	194.06	200.92
124	154.92	160.12	165.55	171.21	177.11	183.27	189.70	196.42	203.43

- (i) Find the future value of an annuity of \$450 per month invested at 6.6% p.a. compounding monthly for 10 years.

1

- (ii) What is the minimum term required for an annuity of \$500 per month at 9% p.a. compounding monthly to reach a value of \$100 000?

1

Question 30 continues on the next page

- (e) Justin buys 3 tickets in a 120 ticket raffle with three prizes.
What is the probability (correct to 3 decimal places) that he wins:

(i) First prize?

1

(ii) Only the third prize?

1

(iii) At least one prize?

1

END OF EXAM

Section II Extra writing space

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

This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Section II Extra writing space

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

[illegible]

Pre-Trial HSC Examination 2015

Mathematics General Course

Student Name: _____

Teacher: _____

Student Number: _____

Section I – Multiple Choice Answer Sheet

Allow about 30 minutes for this section

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 ☒ ^{correct} C ☐ D ☐

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

14. A ☐ B ☐ C ☐ D ☐
15. A ☐ B ☐ C ☐ D ☐
16. A ☐ B ☐ C ☐ D ☐
17. A ☐ B ☐ C ☐ D ☐
18. A ☐ B ☐ C ☐ D ☐
19. A ☐ B ☐ C ☐ D ☐
20. A ☐ B ☐ C ☐ D ☐
21. A ☐ B ☐ C ☐ D ☐
22. A ☐ B ☐ C ☐ D ☐
23. A ☐ B ☐ C ☐ D ☐
24. A ☐ B ☐ C ☐ D ☐
25. A ☐ B ☐ C ☐ D ☐



Student Name: Solutions

Student Number: _____

Pre-Trial 2015

General Mathematics

General Instructions

- Reading time – 5 minutes
- Working time – 2½ hours
- Write using black or blue pen
- Board approved calculators may be used
- A multiple choice answer sheet is provided at the back of this paper
- A formula sheet is provided

Total Marks – 100

Section I

25 marks

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

Section II

75 marks

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

Section I

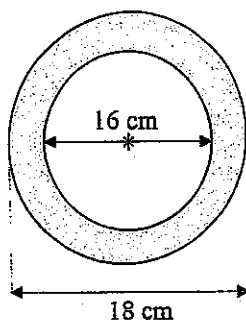
25 marks

Attempt Questions 1 – 25.

Allow about 35 minutes for this section

Use the multiple-choice answer sheet for Questions 1 – 25

1. Which expression could be used to find the shaded area below?



(A) $\pi(9-8)$

(B) $\pi(9^2 - 8^2)$

(C) $\pi(18-16)$

(D) $\pi(18^2 - 16^2)$

2. Mason borrows \$10 000 at 6% p.a. to buy a car and chooses to repay it in monthly repayments over 5 years. The table below shows the monthly repayment schedule.

Find how much he will pay for the car altogether.

Monthly Repayments on a loan of \$10 000

Time (years)

	2	3	4	(5)	6	7	8	
Rate (% p.a.)	4	\$434.25	\$295.24	\$225.79	\$184.17	\$156.45	\$136.69	\$121.89
	5	\$438.71	\$299.71	\$230.29	\$188.71	\$161.05	\$141.34	\$126.60
	(6)	\$443.21	\$304.22	\$234.85	(193.33)	\$165.73	\$146.09	\$131.41
	7	\$447.73	\$308.77	\$239.46	\$198.01	\$170.49	\$150.93	\$136.34
	8	\$452.27	\$313.36	\$244.13	\$202.76	\$175.33	\$155.86	\$141.37

(A) \$193.33

(B) \$966.65

~~(C)~~ \$1599.80

(D) \$11599.80

$$\$193.33 \times 12 \times 5$$

3. Mohsen has three spare tickets to an opera performance. He texts TEN friends on his phone who like opera and offers a ticket each to the first THREE who text him back.

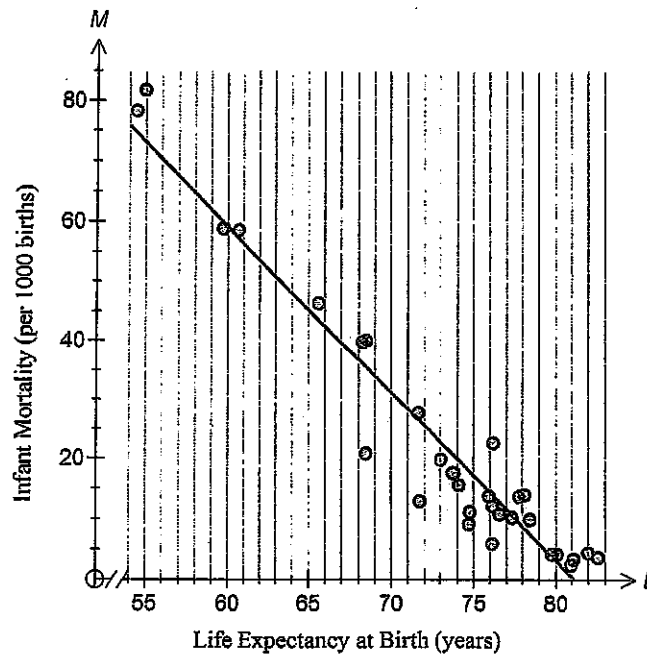
How many different combinations of three friends could get the tickets?

- (A) 120
(B) 240
(C) 360
(D) 720

$$\frac{10 \times 9 \times 8}{3 \times 2 \times 1}$$

4. Josh researches the life expectancy at birth and the infant mortality rate for a number of countries. He then draws a scatterplot with a line of best fit.

What is the likely correlation coefficient for this data?



- (A) -0.08
(B) -0.82
(C) 0.59
(D) 0.95

5. Austin has a laptop which has an internal hard drive with a capacity of 1280 megabytes. He buys an external hard drive with capacity of 12.5 gigabytes to back up his laptop.

Which of the following statements is true?

$$12.5 \text{ gig} = (12.5 \times 1024) \text{ megabytes} \\ = 12800 \text{ megabytes}$$

- (A) The external drive does not have enough capacity to back up his laptop.
 (B) The external drive has twice the capacity needed to back up his laptop.
 (C) The external drive has five times the capacity needed to back up his laptop.
 (D) The external drive has ten times the capacity needed to back up his laptop.

6. Sebastian buys shares in a company for \$0.73 per share. The company pays a dividend of \$0.13 per share. What is the dividend yield?

(A) 0.13%

(B) 5.62%

(C) 17.81%

(D) 21.67%

$$\frac{.13}{.73} \times 100 = 17.808 \dots \%$$

7. Expand and simplify the expression $3ab - 3a(2a - 4b) - a^2$.

(A) $5a^2 - 9ab$.

(B) $7a^2 - 15ab$.

(C) $9ab - 5a^2$.

(D) $15ab - 7a^2$.

$$= 3ab - 6a^2 + 12ab - a^2$$

$$= 15ab - 7a^2$$

8. A group of 150 workers took a competency test in welding and their results were normally distributed. The mean score of the group was 90% with a standard deviation of 5%.

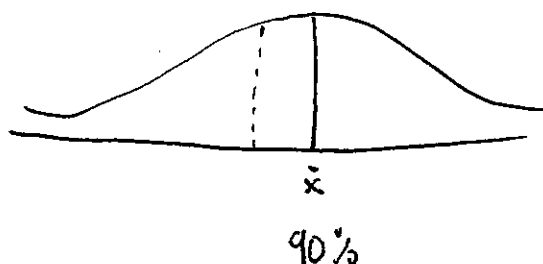
Peter scored 85% on the test. What is this as a z-score?

(A) -2

(B) -1

(C) 1

(D) 2



9. Given the following formula $p = 2\pi(r + \frac{s}{2}) \times q$

Calculate the value of q , when $r = 20$, $s = 30$ and $p = 55$

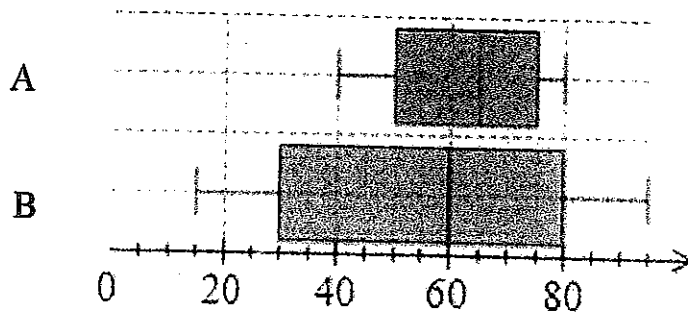
- (A) 0.25
(B) 0.5
(C) 5
(D) 45

$$55 = 2\pi(20 + \frac{30}{2}) \times q$$

$$q = \frac{55}{2\pi(20 + \frac{30}{2})}$$

$$= 0.2501 \dots$$

10. Two examinations results are displayed in the box plot. What is the interquartile range for exam B?



- (A) 25
(B) 40
(C) 50
(D) 80

$$I.Q.R = 80 - 30$$

11. Handicloth is a brand of kitchen cloth which is sold in various sizes and has been tested to absorb liquid at a rate of 5 L/m^2 . How much liquid could a 30 cm square Handicloth absorb?

- (A) 15 mL
(B) 150 mL
(C) 1.5 L
(D) 15 L

$$30 \text{ cm}^2 = (30 \div 100 \div 100) \text{ m}^2$$

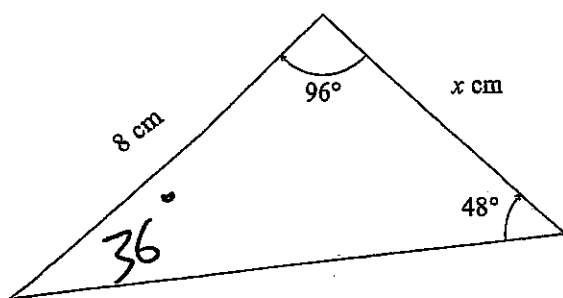
$$= 0.003 \text{ m}^2$$

$$5 \text{ L/m}^2$$

$$5000 \text{ mL/m}^2$$

$$\therefore 5000 \text{ mL} \times 0.003 = 15 \text{ mL}$$

12. The correct solution to find the unknown side:



(A) $x = \frac{8 \sin 96}{\sin 48}$

$$\frac{x}{\sin 36} = \frac{8}{\sin 48}$$

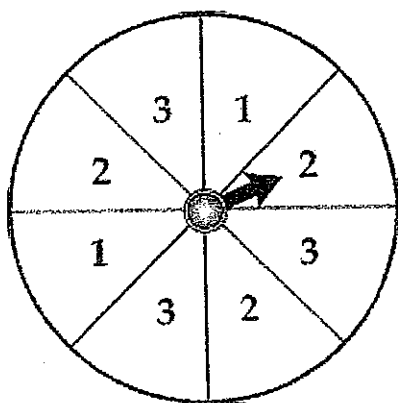
(B) $x = \frac{8 \sin 36}{\sin 48}$

$$x = \frac{8 \sin 36}{\sin 48}$$

(C) $x = \frac{8 \sin 48}{\sin 36}$

(D) $x = \frac{8 \sin 96}{\sin 48}$

13. James uses the spinner for a game. What is the simplified probability of landing on "1"?



(A) $\frac{1}{8}$

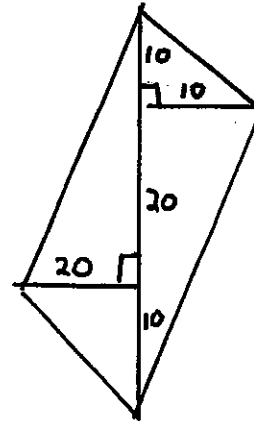
(B) $\frac{2}{8}$

(C) $\frac{3}{8}$

(D) $\frac{1}{4}$

14. What is the area of ABCD using the field book entry

$$\begin{array}{c} \text{D} \\ \text{B} \quad 20 \quad \left| \begin{array}{c} 40 \\ 30 \\ 10 \\ 0 \end{array} \right| \quad 10 \quad \text{C} \\ \text{A} \end{array}$$



- (A) 40
- (B) 450
- (C) 600
- (D) 1200

$$A = \left(\frac{1}{2} \times 40 \times 10 \right) + \left(\frac{1}{2} \times 40 \times 20 \right)$$

15. In a game involving two dice, what is the probability of rolling the same number on both dice?

- (A) $\frac{1}{6}$
- (B) $\frac{1}{2}$
- (C) $\frac{1}{36}$
- (D) $\frac{12}{36}$

$$\frac{6}{36} = \frac{1}{6}$$

16. Brigit sells perfume and receives wages of \$1 250 per month plus 4% commission on all her sales. What are her sales in one month if she receives a total pay of \$1 302?

- (A) \$52.00
- (B) \$1297.92
- (C) \$1300.00
- (D) \$1406.08

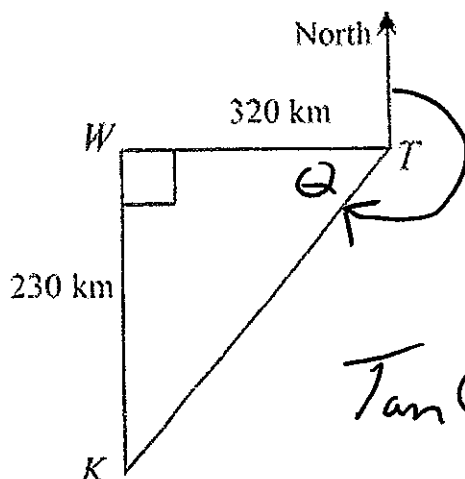
$$1302 = 1250 + 0.04x$$

$$52 = 0.04x$$

$$x = \frac{52}{0.04}$$

17. A plane flies due north from Kensington (K) for 230 km to Wishire (W). It then turns and flies due east for a distance of 320 km to Trenton (T).

What is the bearing of Kensington from Trenton?



$$\tan Q = \frac{230}{320}$$

$$Q = \tan^{-1}\left(\frac{230}{320}\right)$$

$$= 35^{\circ}42'$$

$$= 36^{\circ}$$

$$\therefore 270 - 36 = \underline{234^{\circ}}$$

- (A) 036°
 (B) 216°
 (C) 234°
 (D) 306°

18. Rebecca invests \$1450 in an account for 1 year, which pays 12% p.a. interest, compounding quarterly. At the end of her investment, she adds a further \$1280 to the account.

What is her final balance?

- (A) \$3252.48
 (B) \$2911.99
 (C) \$3277.47
 (D) \$5604.25

$$A = 1450 \left(1 + \frac{0.12}{4}\right)^4$$

$$= \$1631.99$$

$$\therefore \$1631.99 + 1280$$

$$= \$2911.99$$

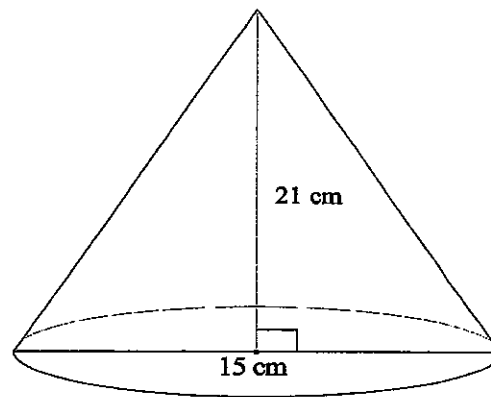
19. Nola's car has a fuel consumption rate of 15 litres/100 km on city roads and 10 litres/100 km on the open highway.

How much fuel will she use in a trip which has 50 km of city driving and 250 km of driving on the open highway?

- (A) 7.5 litres
(B) 25.0 litres
(C) 32.5 litres
(D) 50.0 litres

$$7.5 \text{ L} + 25 \text{ L}$$

20. The volume of the following cone is closest to:



- (A) 1237 cm³
(B) 3711 cm³
(C) 4948 cm³
(D) 14844 cm³

$$V = \frac{1}{3} \times \pi \times 15^2 \times 21$$

$$= 1237$$

21. A sphere has a surface area of 210 cm². Calculate the length of its radius correct to two decimal places.

- (A) 4.08 cm
(B) 4.09 cm
(C) 7.08 cm
(D) 16.71 cm

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

$$210 = 4\pi r^2$$

$$r^2 = \frac{210}{4\pi}$$

$$r = \sqrt{\frac{210}{4\pi}}$$

$$r = 4.087 \dots$$

22. Sam is working as a nurse on a children's ward. He uses Young's formula to calculate an 8 year old child's dose of Adamine.

$$\text{Young's Formula: Dosage for child 1-12} = \frac{\text{age of child (in years)} \times \text{adult dose}}{\text{age of child (in years)} + 12}$$

Given the adult dosage of Adamine is 15 mL, what is the child's dose?

(A) 1.5 mL

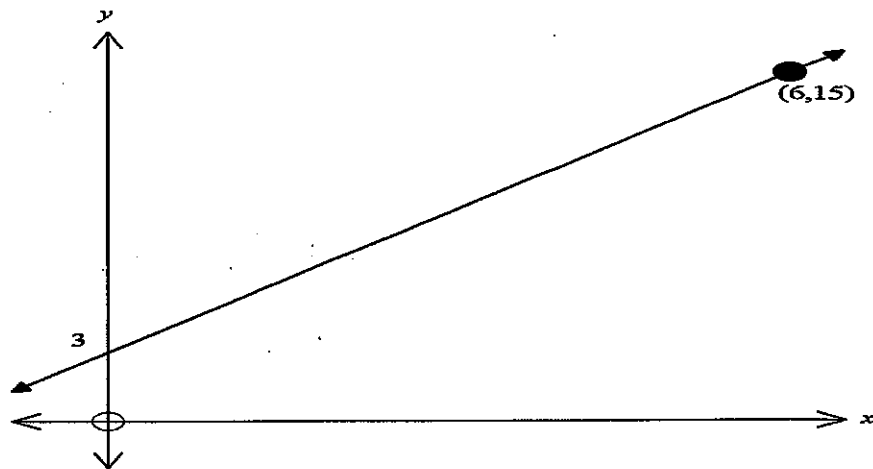
(B) 3 mL

(C) 6 mL

(D) 12 mL

$$\text{dose} = \frac{8 \times 15}{8 + 12}$$

23. This line is best represented by which equation?



(A) $y = 2x + 3$

(B) $y = 3x + 2$

(C) $y = 6x + 3$

(D) $y = 6x + 15$

24. Lauren holds a survey of the residents of her block of units. She recorded some of the results in the two way table below:

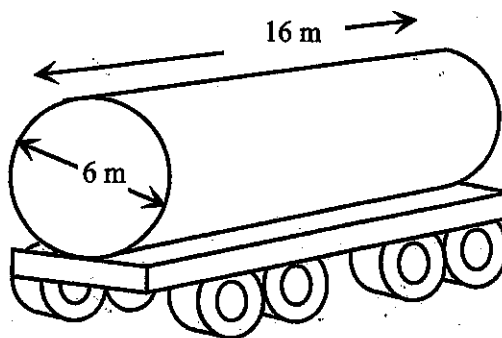
	Male	Female	Total
Problems to report.	16	24	40
No Problems to report.	35	25	60
Total	51	49	100

If a female resident was chosen at random, what is the probability that she had no problems?

- (A) $\frac{6}{25}$
 (B) $\frac{1}{4}$
 (C) $\frac{24}{49}$
 (D) $\frac{25}{49}$

25. A water delivery truck has a cylindrical tank with the dimensions shown, on a trailer.

How many 150 kilolitre house tanks could be filled by the cylindrical tank on the trailer?



Note $1\text{ m}^3 = 1000\text{ L}$
 $1\text{ KL} = 1000\text{ L}$

- (A) 3 tanks
 (B) 6 tanks
 (C) 9 tanks
 (D) 30 tanks

$$V = \pi \times 6^2 \times 16$$

$$= 452.3893 \dots \text{ m}^3$$

$$\therefore = 452389\text{ L (to nearest L)}$$

$$= 452\text{ KL}$$

$$452 \div 150 = 3.01 \dots$$

Section II

75 marks

Attempt Questions 26 - 30

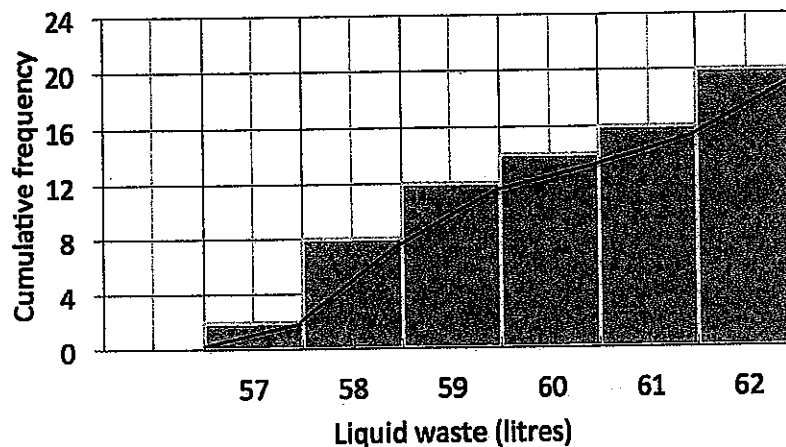
Allow about 115 minutes for this section

Answer each question in the space provided

In Questions 26 – 30, your responses should include relevant mathematical reasoning and/or calculations.

Question 26 (15 marks)

- (a) The cumulative frequency graph below shows the contents (in litres) of all the containers of liquid waste found on a building site.



- (i) How many containers were found on the building site? 1

20 ✓

- (ii) What was the median amount of liquid found in the containers? 1

59 L ✓

Question 26 continues on the next page.

(b) Tracy measures her mass as being 45 kg. On Saturday night she had 4 standard drinks in 2½ hours.

(i) Calculate her BAC and show that it is more than 0.08

1

$$\text{BAC}_{\text{female}} = \frac{(10 \times 4) - (7.5 \times 2.5)}{5.5 \times 45}$$

$$= 0.0859 \text{ (3.d.p.)} \quad \checkmark$$

(ii) When Tracy has a BAC is greater than 0.08, her braking reaction time whilst driving increases by 20%. However her normal reaction time, when unaffected by alcohol in a braking test was 0.9 seconds.

What would her reaction time have been in a braking test *after* drinking on Saturday night? 1

$$1.2 \times 0.9 \text{ sec} = 1.08 \text{ seconds} \quad \checkmark$$

(iii) If she were driving a car travelling at 25 m/s, how many metres *further* would the car have travelled because of her slower reaction time? 1

$$1.08 - 0.9 = 0.18 \text{ s}$$

$$\therefore 0.18 \times 25 \text{ m} = 4.5 \text{ m} \quad \checkmark$$

(c) Petra works in a car yard, where she spends some time doing clerical work and she also acts as a salesperson. She is paid \$21.50 per hour for the time she spends working at the car yard plus a commission of 6% of any sales that she generates.

Last week she worked for 35 hours and generated sales to the value of \$18 000.

(i) What was her gross pay last week?

2

$$\text{Pay} = (35 \times \$21.50) + (0.06 \times 18000)$$

$$= \$1832.50 \quad \checkmark$$

Question 26 continues on the next page

- (ii) Last financial year Chelsea earned a taxable income of \$72 480. Use the table below to calculate the income tax due for the year.

Taxable income	Tax on this income
0 – \$18,200	Nil
\$18,201 – \$37,000	19c for each \$1 over \$18,200
\$37,001 – \$80,000	\$3,572 plus 32.5c for each \$1 over \$37,000
\$80,001 – \$180,000	\$17,547 plus 37c for each \$1 over \$80,000
\$180,001 and over	\$54,547 plus 45c for each \$1 over \$180,000

$$\begin{aligned} \text{Tax} &: \$17\,547 + 0.37(80\,000 - 72\,480) \\ &= \$20\,329.40 \quad \checkmark \end{aligned}$$

Question 26 continues on the next page

- (d) Data was collected from 30 students on the number of text messages they had sent in the previous 24 hours. The set of data collected is displayed.

Male		Female
9 9 8 7 6 5 5 4 2 1	0	8 9
1 1 0 0	1	1 1 2 5 6 8 8 8
0	2	0 1 7
	3	4
	4	
	5	
	6	
1	7	

$$\text{median} = \frac{16 + 18}{2} = 17$$

- (i) What is the sample standard deviation of the data collected from the female students? 1

$$7.1468... = 7.15 (2 \text{ d.p.})$$

- (ii) What is the interquartile range of the data collected from the female students? 2

$$\begin{aligned} IQR &: 20 - 11 \\ &= 9 \end{aligned}$$

- (e) Three digits are randomly chosen from 3, 7, 2, 8, and 4 to make a three digit number. Digits can be repeated. For example, the numbers 363 or 222.

- (i) How many different 3 digit numbers can be made? 1

$$5 \times 5 \times 5 = 125$$

- (ii) What is the probability that this number is odd? 1

$$5 \times 5 \times 2 = 50$$

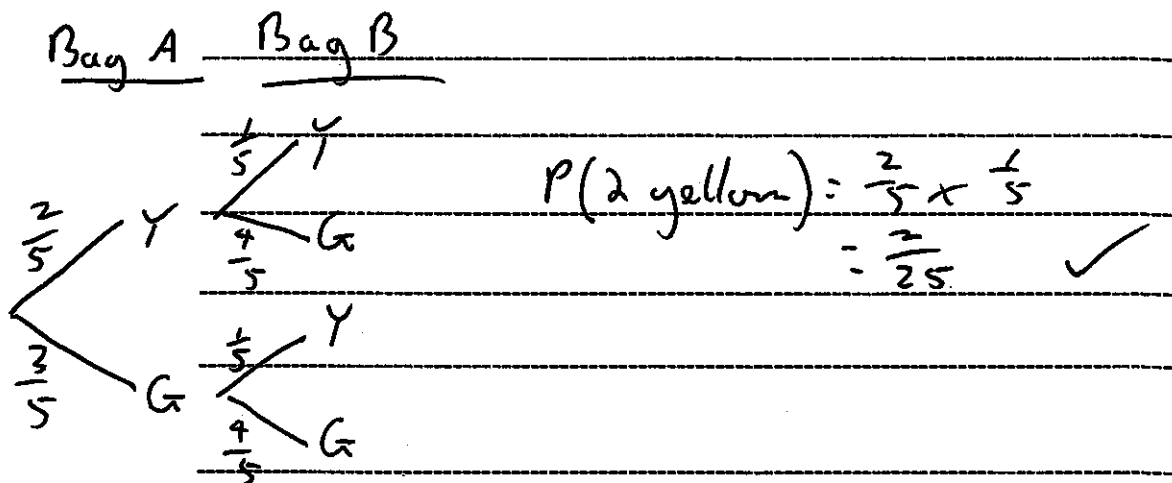
$$\therefore P(\text{odd}) = \frac{50}{125} = \frac{2}{5}$$

Question 26 continues on the next page

- (f) Two bags each contain yellow and green counters. Bag A contains 2 yellow and 3 green counters. Bag B contains 1 yellow and 4 green counters. One counter is chosen from each bag.

(i) What is the probability of drawing two yellow counters?

1



(ii) What is the probability of drawing a yellow and green counter?

1

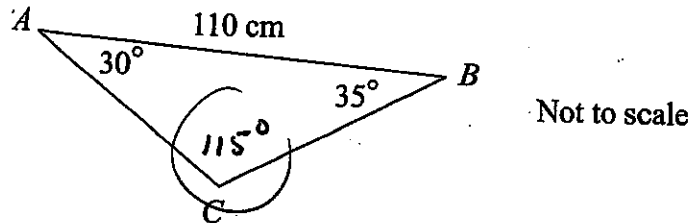
$$P(\text{yellow \& green}) = \left(\frac{2}{5} \times \frac{4}{5} \right) + \left(\frac{3}{5} \times \frac{1}{5} \right)$$

$$= \frac{11}{25} \quad \checkmark$$

End of Question 26

Question 27 (15 marks)

- (a) $\triangle ABC$ has $\angle ABC = 35^\circ$ and $\angle CAB = 30^\circ$. The length of AB is 110 cm.



What is the length of BC , correct to one decimal place?

2

$$\frac{BC}{\sin 30} = \frac{110}{\sin 115}$$

$$BC = \frac{110 \sin 30}{\sin 115} \quad \checkmark$$

$$BC = 60.7 \text{ cm} \quad \checkmark$$

- (b) A freshwater lake contains mainly herrings and catfish. To estimate their numbers, a trawl was done of the lake, which produced 62 herring and 24 catfish.

These were all tagged and released and a month later, another trawl was done which captured 80 herrings of which 6 were tagged and 32 catfish of which 2 were tagged.

How many of the two species would you estimate were in the lake?

2

Herring	Catfish
$\frac{62}{p} = \frac{6}{80}$	$\frac{24}{p} = \frac{2}{32}$
$\frac{p}{62} = \frac{80}{6}$	$\frac{p}{24} = \frac{32}{2}$
$p = 826 \frac{2}{3} \quad \checkmark$	$p = 384 \quad \checkmark$

Question 27 continues on the next page

(c) Solve the following equation $2x - 3 = 2 - 3(x - 1) + 3x$

2

$$2x - 3 = 2 - 3x + 3 + 3x \quad \checkmark$$

$$2x - 3 = 5$$

$$2x = 8$$

$$x = 4 \quad \checkmark$$

(d) Solve the following pair of simultaneous equations.

2

$$2x + y = 12 \rightarrow y = 12 - 2x \dots \text{equ. (1)}$$

$$5x - y = 2 \dots \text{equ. (2)}$$

substitute (1) into (2)

$$\therefore 5x - (12 - 2x) = 2$$

$$5x - 12 + 2x = 2$$

$$7x = 14$$

$$x = 2 \quad \checkmark$$

$$\therefore 2(2) + y = 12$$

$$y = 8$$

$$x = 2, y = 8 \quad \checkmark$$

Question 27 continues on the next page

(e) The marks in a class test are normally distributed. The mean is 100 and the standard deviation is 10.

- (i) Paul's mark is 115. What is his z-score? 1

1.5 ✓

- (ii) Trish has a z-score of 0. What mark did she achieve in the test? 1

100 ✓

- (iii) What percentage of marks lie between 80 and 110? 1

$34\% + \left(\frac{1}{2} \times 95\%\right) = 81.5\%$ ✓

- (f) Ted scored the following number of goals in his 10 most recent games:

16, 16, 15, 16, 15, 14, 14, 12, 17, 15.

What number of goals does Ted need to score in the next game for the mean of his scores to be 16? 1

$$16 = \frac{150 + x}{11}$$

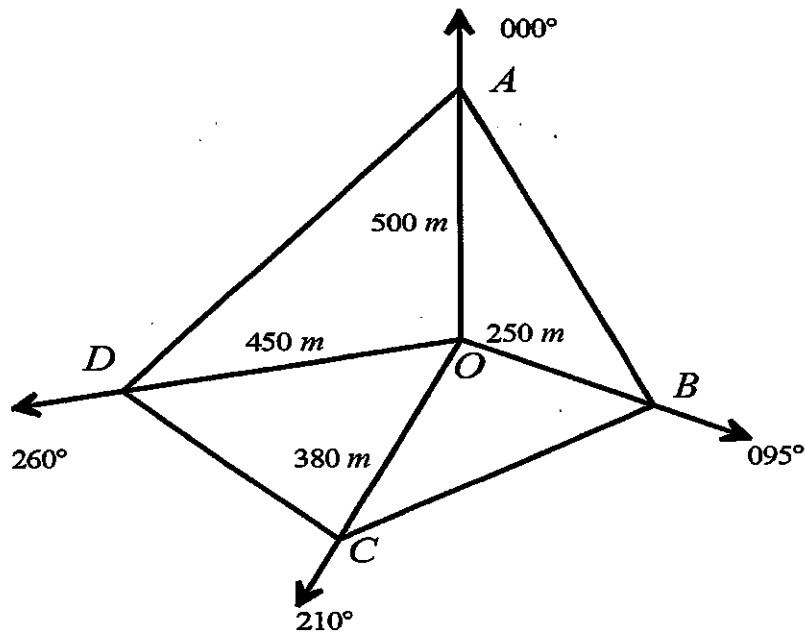
$$176 = 150 + x$$

$$x = 16$$

needs to score 16 goals

Question 27 continues on the next page

- (g) Ryan completes a radial survey of a field $ABCD$, from a central point O . The measurements that he takes are shown on the diagram below.



- (i) Calculate the area of the triangular section AOB , to the nearest m^2 .

1

$$\begin{aligned} A &= \frac{1}{2} \times 500 \times 250 \times \sin 95^\circ \\ &= 62\,262.168 \dots \\ &= 62\,262 \, m^2 \end{aligned}$$

- (ii) Calculate the length of the boundary BC , to the nearest m.

2

$$\begin{aligned} BC^2 &= 380^2 + 250^2 - 2 \times 380 \times 250 \times \cos 115^\circ \\ &= 287\,197.4697 \\ BC &= 535.908 \dots \\ &= 536 \, m \end{aligned}$$

End of Question 27

Question 28 (15 marks)

- (a) Gabi and Toby borrowed \$465 000 at 8% p.a. reducible interest. The interest is charged monthly and the monthly repayment is \$3550. The table shows the amounts owing during the first three months

Months	Principal	Interest	$P + I$	$P + I - R$
1	\$465 000	\$3100	\$468 100	\$464 550
2	\$464 550	\$3097	\$467 647	\$464 097
3	\$464 097	\$3093.98		

- (i) What is the principal at the beginning of the second month?

1

\$464 550 ✓

- (ii) How much is owed at the end of the second month?

1

\$464 097 ✓

- (iii) Calculate the interest to be paid at the beginning of the third month?

1

$$\$464\,097 \times \frac{0.08}{12} = \$3093.98 \quad \checkmark$$

Question 28 continues on the next page

- (b) A microdrip IV pump that delivers 60 drops/mL is used to administer medications and fluids. It requires a drip rate in drops per minute (dpm) to be set.

The formula below is used to calculate the drip rate:

$$\text{Drip rate} = \frac{\text{volume(mL)} \times \text{drops/mL}}{\text{time in minutes}}$$

- (i) A patient requires 1200 mL of fluid to be given intravenously over 10 hours. Calculate the drip rate?

$$\begin{aligned} \text{drip rate} &= \frac{1200 \times 60}{600} \\ &= 120 \text{ dpm} \quad \checkmark \end{aligned}$$

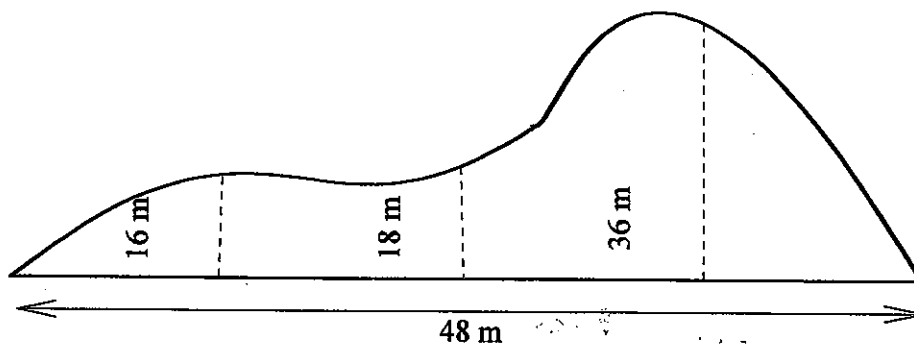
- (ii) Jason is working on a ward and notices the drip rate on a patient's microdrip IV is set to 75 dpm. The IV has a volume of 900 mL.

How long should this IV run?

$$\begin{aligned} 75 &= \frac{900 \times 60}{m} \quad \checkmark \\ 75m &= 900 \times 60 \\ m &= 720 \\ \therefore \text{the IV should run for } \underline{720 \text{ minutes}} \\ &\quad \underline{\text{or } 12 \text{ hours}} \quad \checkmark \end{aligned}$$

Question 28 continues on the next page

(c) The area of a field is shown below. All measurements are metres.



Use two applications of Simpson's rule to approximate the area of the field.

2

$$A_1 = \frac{12}{3} (0 + (4 \times 16) + 18)$$

$$= 328$$

$$A_2 = \frac{12}{3} (18 + (4 \times 36) + 0) \quad \checkmark$$

$$= 648$$

$$\text{Total Area} = 976 \text{ m}^2 \quad \checkmark$$

Question 28 continues on the next page

- (d) James rolls a die. If he rolls a 5 he wins \$15, but if he rolls an even number he loses \$2. What is his financial expectation?

1

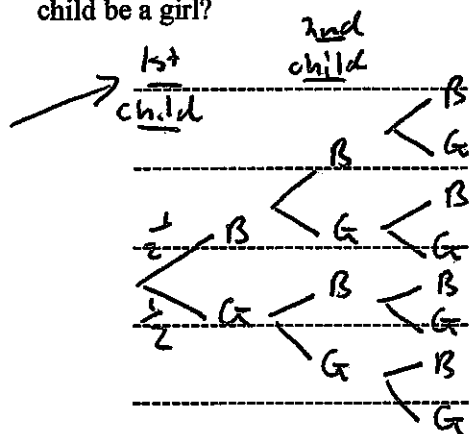
$$Fin\ Exp = \left(\frac{1}{6} \times \$15\right) + \left(\frac{1}{2} \times -\$2\right)$$

$$= \$1.50$$

- (e) Out of 220 families that have 3 children, how many would you expect to have their eldest child be a girl?

2

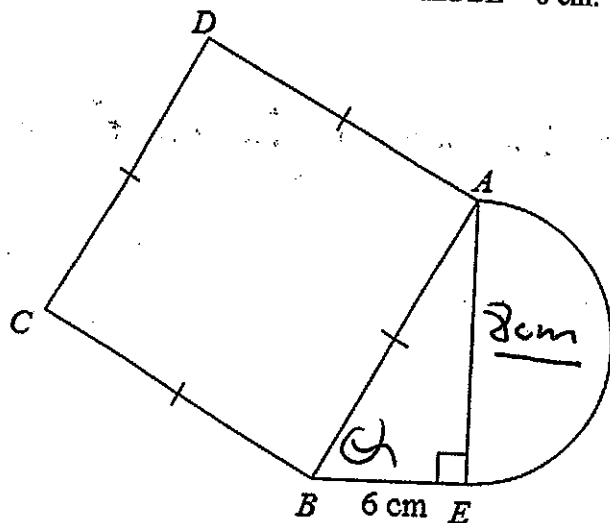
eldest
child
will be
our 1st
child



$$\therefore \frac{1}{2} \times 220 = 110 \text{ families}$$

Question 28 continues on the next page

- (f) A piece of aluminium consists of a semicircle, a right triangle and a square. The radius of the semicircle is 4 cm and $BE = 6$ cm.



- (i) What is the length of AE ?

1

$$2 \times 4 \text{ cm} = 8 \text{ cm} \quad \checkmark$$

- (ii) Calculate $\angle ABE$. Answer to the nearest degree.

1

$$\tan Q = \frac{8}{6}$$

$$Q = 53^\circ \quad \angle ABE = 53^\circ \quad \checkmark$$

- (iii) Show that the length of AB is 10 cm.

1

$$AB^2 = AE^2 + BE^2$$

$$= 8^2 + 6^2$$

$$= 64 + 36$$

$$= 100$$

$$\therefore AB = 10 \text{ cm} \quad \checkmark$$

Question 28 (e) continues on next page

(iv) Calculate the total area of this piece of aluminium.

Answer correct to the nearest square centimetre.

2

$$\text{Area} = (10 \times 10) + \left(\frac{1}{2} \times 6 \times 8\right) + \left(\frac{1}{2} \times 22 \times 4\right) \checkmark$$

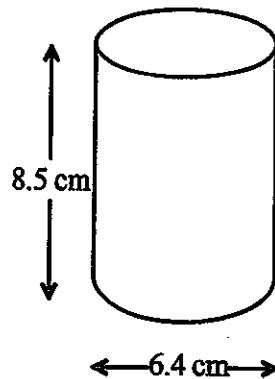
$$= 149.1327 \dots$$

$$= 149 \text{ cm}^2 \checkmark$$

End of Question 28

Question 29 (15 marks)

- (a) A machine on a production line produces solid metal cylindrical parts. The design specifies a diameter of 6.4 cm and a height of 8.5 cm.



- (i) Calculate the surface area of the cylinder, correct to one decimal place.

1

$$\begin{aligned} S.A. &= [2 \times \pi \times (3.2)^2] + (2 \times \pi \times 3.2 \times 8.5) \\ &= 64.3398 \dots + 170.9026 \\ &= 235.2424 \dots \\ &= 235.2 \text{ cm}^2 \end{aligned}$$

- (ii) Cylinders that come off the production line have diameters are normally distributed with a mean of 6.3 cm and a standard deviation of 0.05 cm.

Any cylinders with a diameter greater than 6.4 cm or less than 6.25 cm must be rejected.

What percentages of the cylinders are rejected?

2

$$\begin{aligned} \text{Rejected} &= 100\% - (34\% + 47.5\%) \\ &= 18.5\% \end{aligned}$$

Question 29 continues on the next page

- (b) The table shows present value interest factors for some monthly interest rates (r) and loan terms in months (N).

	Monthly Interest Rate (r)						
	0.4%	0.45%	0.5%	0.55%	0.6%	0.65%	0.7%
112	90.1310	87.8238	85.5987	83.4522	81.3812	79.3827	77.4536
113	90.7680	88.4259	86.1678	83.9903	81.8899	79.8636	77.9082
114	91.4023	89.0253	86.7342	84.5254	82.3955	80.3413	78.3597
115	92.0342	89.6220	87.2977	85.0576	82.8981	80.8160	78.8081
116	92.6636	90.2160	87.8584	85.5868	83.3977	81.2877	79.2533
117	93.2904	90.8074	88.4163	86.1132	83.8944	81.7562	79.6954
118	93.9147	91.3961	88.9714	86.6367	84.3880	82.2218	80.1345
119	94.5366	91.9822	89.5238	87.1573	84.8788	82.6844	80.5705
120	95.1560	92.5656	90.0735	87.6751	85.3666	83.1439	81.0035
121	95.7729	93.1465	90.6204	88.1901	85.8515	83.6005	81.4334
122	96.3873	93.7247	91.1645	88.7022	86.3335	84.0542	81.8604

Ruby borrows \$6500 for home improvements. She repays the loan with monthly repayments over 10 years. She is charged 6% p.a. interest.

6% p.a. : 0.5% per month
10 years : 120 periods

- (i) Calculate the amount of her monthly instalment.

1

$$\therefore 90.0735 \times \text{monthly repayment} = \$6500$$

$$\text{monthly repay} = \$72.16$$

- (ii) How much less interest would she pay if she took the loan over 9.5 years instead of 10 years?

2

$$\text{Total repayment 10 yrs} = \$72.16 \times 120$$

$$= \$8659.20$$

$$9\frac{1}{2} \text{ years} = 108 + 6$$

$$= 114 \text{ months/periods}$$

$$\text{monthly repayment} \times 86.7342 = \$6600$$

$$\text{monthly repay} = \$74.94$$

Question 29 continues on the next page

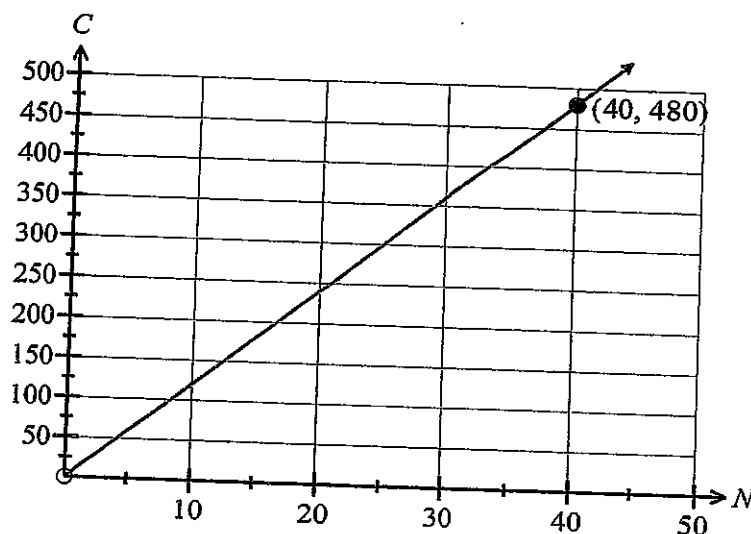
$$\text{Total repaid in } 9\frac{1}{2} \text{ years} = \$74.94 \times 114$$

$$= \$8543.16$$

$$\text{Amt of int. saved} = \$8659.20 - \$8543.16$$

$$= \$116.04$$

- (c) Ebony is the manager of a company that produces widgets. She draws the graph of the line, which gives the income (C) from selling (N) widgets.



What is the equation of the line?

1

$$C = 12N \quad \checkmark$$

- (d) Coffs Harbour in New South Wales is located at $(30^\circ\text{S}, 153^\circ\text{E})$ and Springbok in South Africa is located at $(30^\circ\text{S}, 18^\circ\text{E})$.

- (i) What is the time difference between these places?

1

$$153 - 18 = 135^\circ$$

$$\therefore 135 \div 15 = 9 \text{ hours difference} \quad \checkmark$$

- (ii) What is the time and day in Springbok if it is Tuesday 3 a.m. at Coffs Harbour? (Ignore time zones).

1

S		C
18°E	9 hrs	153°E

Tues 3. a.m

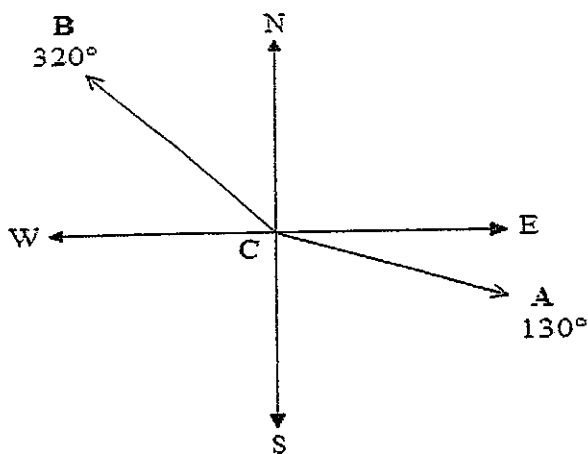
$\therefore$ it is 6 pm Monday $\checkmark$

Question 29 continues on the next page

(e) Ship *A* and *B* leave port *C* at 10.00 am in different directions.

Ship	Bearing from <i>C</i>	Speed
<i>A</i>	130°	40 km/h
<i>B</i>	320°	25 km/h

The diagram below shows the courses of each of the ships from port *C*.



- (i) Calculate the distance travelled by each ship by 2.00 pm. 1

$$\begin{aligned} \text{Ship A} &= 4 \times 40 \\ &= 160 \text{ km} \\ \text{Ship B} &= 4 \times 25 \\ &= 100 \text{ km} \end{aligned}$$

- (ii) What is the size of $\angle ACB$? 1

$$\begin{aligned} \angle ACB &= 40 + 130 \\ &= 170^\circ \end{aligned}$$

Question 29 (e) continues on the next page

- (iii) What is the distance AB between the ships at 2.00 pm?
Answer correct to the nearest kilometre.

2

$$\begin{aligned} AB^2 &= 160^2 + 100^2 - 2 \times 160 \times 100 \times \cos 170^\circ \quad \checkmark \\ &= 67113.8481 \\ &= 259 \text{ km} \quad \checkmark \end{aligned}$$

- (e) Nancy buys a car which has a market value of \$72 000 before on-road costs.

Stamp duty on the car is calculated at these rates:

- 3.5% of the market value up to and including \$45,000
- 5% of the market value over \$45,000.

Calculate the stamp duty payable on the purchase of the car.

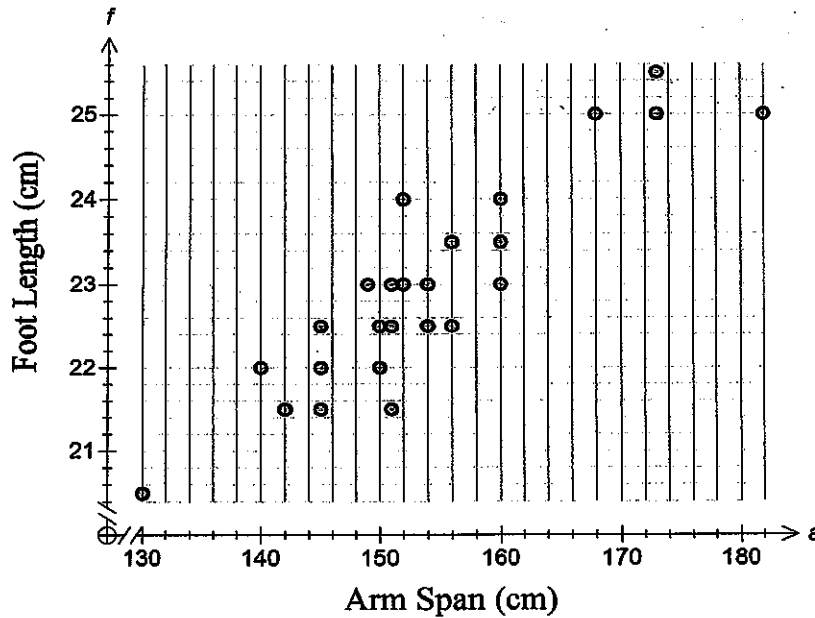
2

$$\begin{aligned} \text{Stamp duty} &= (0.035 \times \$45\,000) + \\ &\quad (0.05 \times \$27\,000) \\ &= \$1\,575 + 1\,350 \quad \checkmark \\ &= \$2\,925 \quad \checkmark \end{aligned}$$

End of Question 29

Question 30 (15 marks)

- (a) James collects data from a sample of students in all years of her school. She draws the scatterplot below using the data she collected on arm span and foot length.



James uses a statistics software package to calculate the correlation coefficient and gets a value of 0.9.

Explain what this result tells you about arm span and foot length.

1

A correlation approaching 1 means that as one quantity increases, so does the other in a close linear relationship ✓

Question 30 continues on the next page

- (b) The statistics package also gives the results below for the mean and standard deviation of the two quantities.

	Arm Span (a)	Foot Length (f)
Mean	154.0	23.0
SD	11.3	1.3

- (i) Use the above information to show that the gradient of the least-squares line of best fit is approximately 0.1, correct to 1 decimal place.

2

$$\begin{aligned} \text{gradient} &= 0.9 \times \frac{1.3}{11.3} \quad \checkmark \\ &= 0.10353 \dots \\ &= 0.1 \quad \checkmark \end{aligned}$$

- (ii) Use the information above to calculate the intercept of the least-squares line of best fit on the f axis, correct to 1 decimal place.

2

$$\begin{aligned} y\text{-int.} &= \bar{y} - (\text{gradient} \times \bar{x}) \\ f\text{-int.} &= \bar{f} - (\text{gradient} \times \bar{a}) \\ &= 23 - 0.1 \times 154 \quad \checkmark \\ &= 7.6 \end{aligned}$$

- (iii) Using the variables a and f , write down the equation of the least-squares line of best fit.

Use it to estimate the foot length of a student whose arm span was 170 cm.

2

$$\begin{aligned} f &= 0.1a + 7.6 \quad \checkmark \\ \text{When } a &= 170 \\ f &= 0.1(170) + 7.6 \\ &= 24.6 \text{ cm} \quad \checkmark \end{aligned}$$

- (c) Jimmy analyses the retention rate, which is the percentage of information recalled at the next lesson for classes at the local community college. Lessons are one hour OR half hour in length and are held in the morning, afternoon or evening.

The table shows a summary of his results:

Length of Lesson		Time of Day		
		Afternoon	Evening	Morning
Half-Hour	Mean of Retention Rate	51%	43%	
	Standard Deviation of Retention Rate	10%	15%	
Hour	Mean of Retention Rate	65%	62%	73%
	Standard Deviation of Retention Rate	7%	10%	11%

- (i) The mean and standard deviation for the morning half hour class is missing. The raw data for the 8 students in the morning half-hour class is given below:

35% 55% 45% 40% 65% 40% 40% 50%

Find the mean and standard deviation for this class.

2

mean = 46% ✓

SD = 9% ✓

- (ii) Which class had the greatest variability i.e. spread, in their retention rates?

1

The evening half-hour class ✓
(it has a SD of 15%)

Question 30 continues on the next page

(d) The table below gives the future value interest factors for a range of loan terms and interest rates.

Table of future value interest factors									
Periods	Interest Rate per Period								
	0.35%	0.40%	0.45%	0.50%	0.55%	0.60%	0.65%	0.70%	0.75%
116	142.78	147.23	151.87	156.69	161.70	166.92	172.35	178.00	183.89
117	144.28	148.82	153.55	158.47	163.59	168.92	174.47	180.25	186.26
118	145.78	150.42	155.24	160.26	165.49	170.93	176.60	182.51	188.66
119	147.29	152.02	156.94	162.06	167.40	172.96	178.75	184.79	191.08
120	148.81	153.63	158.65	163.87	169.32	175.00	180.91	187.08	193.51
121	150.33	155.24	160.36	165.69	171.25	177.05	183.09	189.39	195.96
122	151.86	156.86	162.08	167.52	173.19	179.11	185.28	191.72	198.43
123	153.39	158.49	163.81	169.36	175.15	181.19	187.48	194.06	200.92
124	154.92	160.12	165.55	171.21	177.11	183.27	189.70	196.42	203.43

- (i) Find the future value of an annuity of \$450 per month invested at 6.6% p.a. compounding monthly for 10 years.

1

$$\begin{aligned} \text{Int. rate} &= \frac{6.6}{12} = 0.55\% \text{ per month} \\ \text{Periods} &= 10 \times 12 = 120 \\ \therefore \text{FV} &= \$450 \times 169.32 \\ &= \$76194 \end{aligned}$$

- (ii) What is the minimum term required for an annuity of \$500 per month at 9% p.a. compounding monthly to reach a value of \$100 000?

1

$$\begin{aligned} \$100\,000 &= 500 \times x \\ x &= 200 \\ \text{Note} \\ \frac{9}{12} &= 0.75\% \\ \therefore 123 \text{ months or } 10 \text{ yrs } 3 \text{ months} \end{aligned}$$

Question 30 continues on the next page

- (e) Justin buys 3 tickets in a 120 ticket raffle with three prizes.
What is the probability (correct to 3 decimal places) that he wins:

(i) First prize?

$$\frac{3}{120} = \frac{1}{40}$$

$$= 0.025 \quad \checkmark$$

1

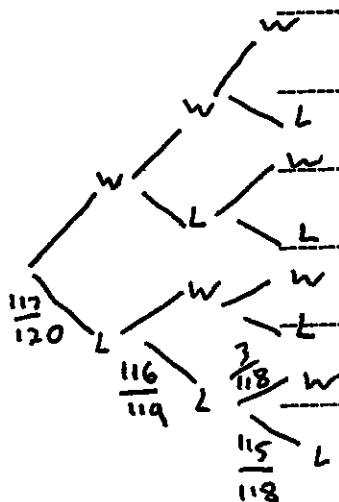
(ii) Only the third prize?

1

$$P(\text{win only 3rd prize}) = P(L) \times P(L) \times P(W)$$

$$= \frac{117}{120} \times \frac{116}{119} \times \frac{3}{118}$$

$$= 0.024 \text{ (3 d.p.)} \quad \checkmark$$



(iii) At least one prize?

1

$$P(\text{at least one prize}) = 1 - P(\text{no prize})$$

$$= 1 - \left(\frac{117}{120} \times \frac{116}{119} \times \frac{115}{118} \right)$$

$$= \frac{2071}{28080}$$

$$= 0.074 \text{ (3 d.p.)} \quad \checkmark$$

END OF EXAM

Solutions

Pre-Trial HSC Examination 2015 Mathematics General Course

Name: _____ Teacher: _____

Student Number: _____

Section I – Multiple Choice Answer Sheet

Allow about 15 minutes for this section

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 ☒ ^{correct} C ☐ D ☐

1. A ☐ B ☒ C ☐ D ☐
2. A ☐ B ☐ C ☐ D ☒
3. A ☒ B ☐ C ☐ D ☐
4. A ☐ B ☒ C ☐ D ☐
5. A ☐ B ☐ C ☐ D ☒
6. A ☐ B ☐ C ☒ D ☐
7. A ☐ B ☐ C ☐ D ☒
8. A ☐ B ☒ C ☐ D ☐
9. A ☒ B ☐ C ☐ D ☐
10. A ☐ B ☐ C ☒ D ☐
11. A ☒ B ☐ C ☐ D ☐
12. A ☐ B ☒ C ☐ D ☐
13. A ☐ B ☐ C ☐ D ☒

14. A ☐ B ☐ C ☒ D ☐
15. A ☒ B ☐ C ☐ D ☐
16. A ☐ B ☐ C ☒ D ☐
17. A ☐ B ☐ C ☒ D ☐
18. A ☐ B ☒ C ☐ D ☐
19. A ☐ B ☐ C ☒ D ☐
20. A ☒ B ☐ C ☐ D ☐
21. A ☐ B ☒ C ☐ D ☐
22. A ☐ B ☐ C ☒ D ☐
23. A ☒ B ☐ C ☐ D ☐
24. A ☐ B ☐ C ☐ D ☒
25. A ☒ B ☐ C ☐ D ☐