

4 Which pair of simultaneous equations has the solution $x = -5$, $y = 3$?

- (A) $y = x + 8$, $4x - 3y = 29$
- (B) $y - x = 8$, $4x - 3y = 26$
- (C) $y = x + 8$, $3x - 2y = -21$
- (D) $x + y = 2$, $5x + y = -22$

5 Caprice buys a car for \$22 000. It depreciates at a rate of 5% per year.

Which of the following best describes its value, S dollars, at the end of two years?

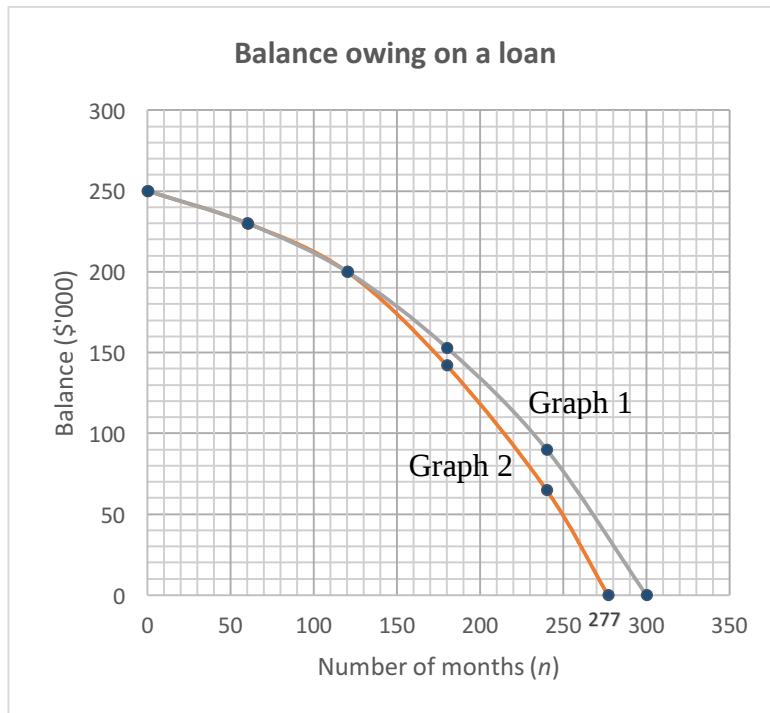
- (A) $S = 22000(1 + 0.05)^2$
- (B) $S = 22000(1 - 0.05)^2$
- (C) $S = 22000 \times 0.05 \times 2$
- (D) $S = 22000 - 20000 \times 0.05 \times 2$

6 In a science test, a class of 24 boys had a mean of 56 and a class of 16 girls had a mean of 66.

What is the combined mean of the two classes?

- (A) 61
- (B) 56
- (C) 60
- (D) 62

7 Questions 7 and 8 refer to the graph below.



Graph 1 shows the balance owing on a loan of \$250 000 at 7.2% p.a. compounding monthly over 25 years. The monthly repayment is \$1799. Graph 2 shows the balance if the borrower starts paying an extra \$100 each month after 120 months.

According to the graphs, for how many months was the extra \$100 paid?

- (A) 120
 - (B) 157
 - (C) 180
 - (D) 277
- 8 What is the total cost of the loan if the borrower uses graph 2 with the extra \$100 monthly payments?
- (A) \$514 023
 - (B) \$569 700
 - (C) \$526 023
 - (D) \$498 323

- 9** A flash-drive can store 64GB of memory. How many files with an average size of 2MB can be stored on the flash drive?

(A) 32
(B) 3200
(C) 32000
(D) 32768

- 10** Expand and simplify $5x^2(x^2 - 1) - 2x^2$.

(A) $5x^4 - 2x^2 - 1$
(B) $5x^4 + 7x^2$
(C) $5x^4 - 7x^2$
(D) $8x^2$

- 11** Maxine's gross earnings last year were \$59 000 and she had taxable deductions of \$2200. The Medicare levy is 1.5% of the taxable income.

What is the Medicare levy paid by Maxine?

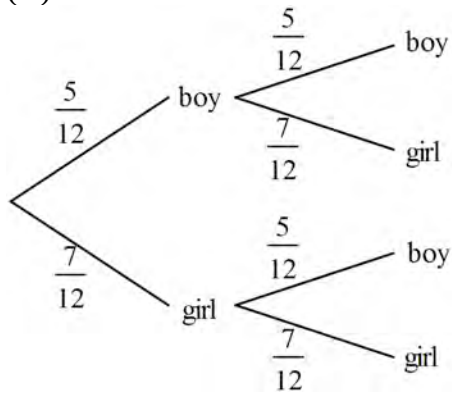
(A) \$612
(B) \$852
(C) \$885
(D) \$918

- 12 A group of 5 friends want to take a selfie with just three girls. How many different groups of three are possible?
- (A) 5
(B) 6
(C) 10
(D) 60
- 13 Which calculation is used to convert 1.4MB to kilobits?
- (A) $1.4 \times 1000^2 \div 8 \div 1024^2$
(B) $1.4 \times 1000^2 \times 8 \div 1024^2$
(C) $1.4 \times 1024^2 \times 8 \div 1000$
(D) $1.4 \times 1024^2 \div 8 \div 1000$
- 14 For the data set below, which statement is correct?
- 25, 45, 64, 48, 66, 85, 45, 27
- (A) The sample standard deviation is 20.29 (to 2 decimal places)
(B) The mean is 50.625.
(C) The population standard deviation is 18.98 (to 2 decimal places)
(D) All of the above
- 15 Minyi borrows \$12 500 for a term of 6 years at a flat rate of 8.25% p.a. The loan including interest is paid back in equal monthly installments. What is the amount of the monthly repayment?
- (A) \$259.55
(B) \$3114.58
(C) \$6187.50
(D) \$18687.50

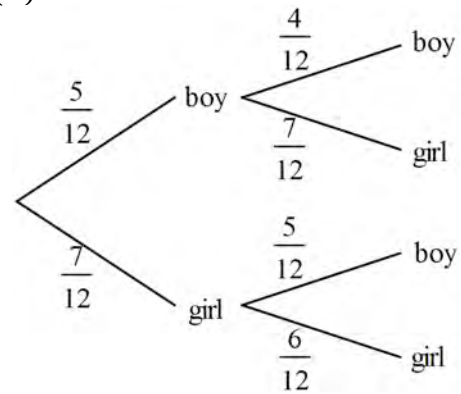
- 16** From 5 boys and 7 girls, two children are chosen at random to work together on a project.

Which of the following probability trees could be used to determine the probability of choosing a boy and a girl?

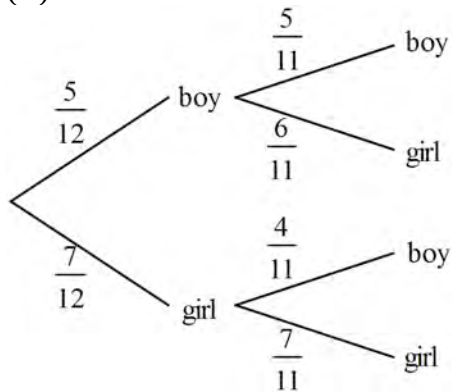
(A)



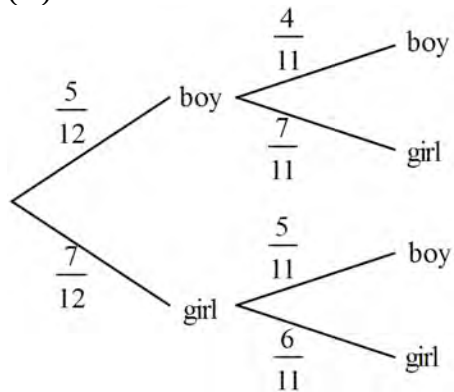
(B)



(C)



(D)

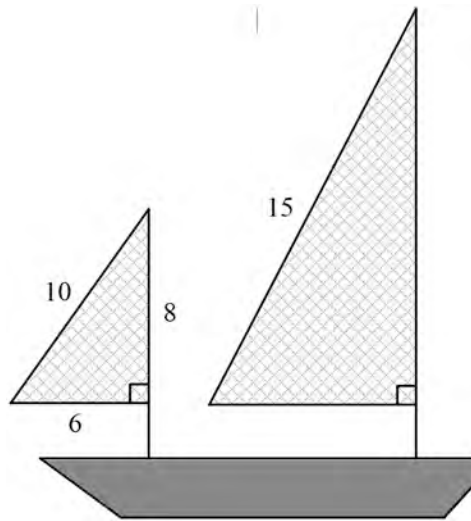


- 17** A certain brand of pain relief tablets contain 500 mg of Paracetamol. For adults, it is recommended that no more than 8 tablets are taken in a 24 hour period.

What is the maximum amount of Paracetamol that an adult should ingest in a 24 hour period?

- (A) 4 g
- (B) 62.5 g
- (C) 167 g
- (D) 4000 g

- 18** A model boat has 2 triangular sails which are similar to each other. The dimensions are shown in cm.



What is the total area of both sails?

- (A) 24 cm^2
 - (B) 72 cm^2
 - (C) 78 cm^2
 - (D) 95.5 cm^2
- 19** A password must have 3 digits with no repeats.
- How many 3-digit passwords are greater than 600?
- (A) 288
 - (B) 360
 - (C) 400
 - (D) 504
- 20** During the April storm in Sydney, 110mm of rain fell on Wahroonga which has an area of 12 km^2 .
- What is the approximate volume of water that this represents?
- (A) $110 \times 12 \text{ m}^3$
 - (B) $0.11 \times 12\,000 \text{ m}^3$
 - (C) $0.11 \times 12\,000\,000 \text{ m}^3$
 - (D) $0.000\,11 \times 12\,000\,000 \text{ m}^3$

- 21 A sample of 2 computer chips is selected without replacement from a batch of 15 computer chips. It is known that 6 of the computer chips are defective.

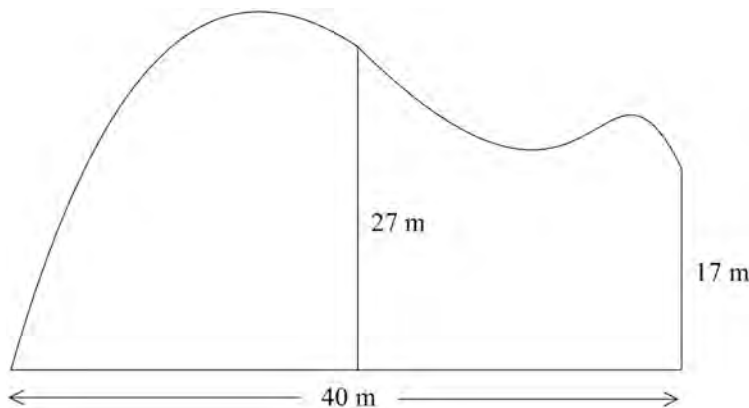
What is the probability that only one of the selected computer chips is defective?

- (A) $\frac{6}{15}$
 (B) $\frac{9}{35}$
 (C) $\frac{18}{35}$
 (D) $\frac{9}{15}$

- 22 When r is made the subject of $v = \sqrt{\frac{mr}{2\pi}}$ then $r =$

- (A) $\frac{4\pi^2 v^2}{m^2}$
 (B) $\frac{2\pi v^2}{m}$
 (C) $\frac{2\pi v^2}{m^2}$
 (D) $\frac{2\pi v}{m}$

- 23 Which expression would correctly estimate the area in the diagram using one application of Simpson's Rule?



- (A) $\frac{40}{3}(27+17) \text{ m}^2$
 (B) $\frac{40}{3}(4 \times 27 + 17) \text{ m}^2$
 (C) $\frac{20}{3}(27+17) \text{ m}^2$
 (D) $\frac{20}{3}(4 \times 27 + 17) \text{ m}^2$

- 24 Which of the following best describes the cost in dollars of running a 3600-watt (3.6 kW) air conditioner for 4 hours per day for 31 days if the cost of electricity is \$0.22/kWh?

(A) $3.6 \times 4 \times 31 \times 0.22$
(B) $3600 \times 4 \times 31 \times 0.22$
(C) $3.6 \times 4 \times 31$
(D) $3600 \times 4 \times 31$

- 25 The volume of a sphere increases as the cube of its radius. The radius is increased by 20%. What is the increase in volume?

Volume of a sphere $= \frac{4}{3} \pi r^3$.

(A) 0.002%
(B) 20%
(C) 17.28%
(D) 72.8%

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Mathematics General 2

STUDENT NAME.....

TEACHERS NAME.....

Section II

Question 26 (15 marks)

Allow about 23 minutes for this question.

Answer the questions in the spaces provided.

Your responses should include relevant mathematical reasoning and/or calculations.

Extra writing space is provided on the last page of the paper.

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

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Question 26 (15 marks)

- (a) If $a = 8b^3 - 10$, find the value of b when a is 17.

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- (b) The formula for drip rate for a certain medication is:

$$\text{Drops per minute} = \frac{\text{total volume to be given (in mL)}}{\text{time (in minutes)}} \times \text{drop factor}$$

A patient requires 1200 mL of medication over a 10 hour period.
If the drop factor is 30, calculate the drip rate in drops per minute.

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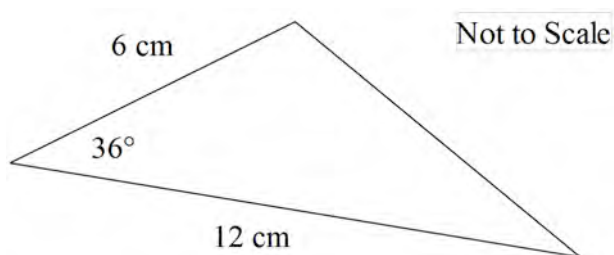
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(c)



(i) Calculate the area of the triangle. Answer to 1 decimal place.

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(ii) Calculate the perimeter of the triangle correct to 1 decimal place.

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- (d) The back to back stem and leaf plot shows the ages of 25 male and 25 female actors when they received their award for Best Actor or Best Actress.

Actors (male)	Stem	Actors (female)
	2	1 4 6 6 6
9 8 7 5 3 2 1	3	0 0 1 1 3 3 4 4 4 5 7
8 8 7 7 6 4 3 3 2 2 1 0	4	1 1 1 1 9
6 5 1	5	
2 0	6	0 1
6	7	5
	8	0

- (i) What is the median age of each group? 2

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- (ii) What do the median ages tell us about the awards for best male and female actors? 1

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- (iii) Describe the skewness of the data for the male actors. 1

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- (iv) Does the highest score in the female actors qualify as an outlier? 3
Support your answer with mathematical calculations.

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Section II Extra writing space

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Mathematics General 2

STUDENT NAME.....

TEACHERS NAME.....

Section II

Question 27 (15 marks)

Allow about 23 minutes for this question.

Answer the questions in the spaces provided.

Your responses should include relevant mathematical reasoning and/or calculations.

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Question 27 (15 marks)

(a) A 10 year term deposit offers an interest rate of 6% p.a. compound monthly.

(i) What is the future value of an investment of \$5000? **2**

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(ii) What single amount must be invested now to ensure a future value of \$12 000? **1**

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(b) Bella's car uses 6.3L/100km.

(i) How much petrol does she use to travel 1375km from Sydney to Adelaide? **1**
Answer to 1 decimal place.

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(ii) Petrol cost \$1.20 /L. How far, to the nearest kilometre, can she travel on \$75? **1**

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- (c) On 15th March 2015, Dilnoor bought a digital camera costing \$1600 using a credit card. Simple interest was charged at a rate of 21.35% per annum for purchases. There is no interest -free period.

The period for which interest was charged included the date of purchase and the date of payment. Dilnoor made no other purchases on her card.

What amount was paid when the account was paid in full on 20th April 2015?

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- (d) Casual employees at the Café Olé are paid \$14 per hour. They earn time-and-a-half on Saturdays and double time on Sundays.

The timesheet for a given week is shown below.

Café Olé casual employee time sheet								
Name		MON	TUE	WED	THU	FRI	SAT	SUN
Nathan	Start	0800		1100			0900	
	Finish	1400		1900			1500	
Jamie	Start		1200	1000	1200			
	Finish		2200	1600	2000			
Indira	Start					1000	1200	1000
	Finish					1500	2000	1600

- (i) How many hours did Jamie work this week? 1

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- (ii) How many extra hours must Jamie work on a Saturday to earn \$441 in a week? 2

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- (iii) Calculate Indira's total earnings for the week. 2

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- (e) Helena recorded the number of births at a hospital over the period of a week.

Outcome	Frequency
Number of girls born	144
Number of boys born	156

- (i) What is the relative frequency of a girl being born? 1

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- (ii) Over a period of 4 weeks there were 850 children born at the hospital.
Helena calculated that the number of girls born should be 408.

Is her calculation correct or not? 1
Justify your answer with mathematical calculations.

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Mathematics General 2

STUDENT NAME.....

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Section II

Question 28 (15 marks)

Allow about 23 minutes for this question.

Answer the questions in the spaces provided.

Your responses should include relevant mathematical reasoning and/or calculations.

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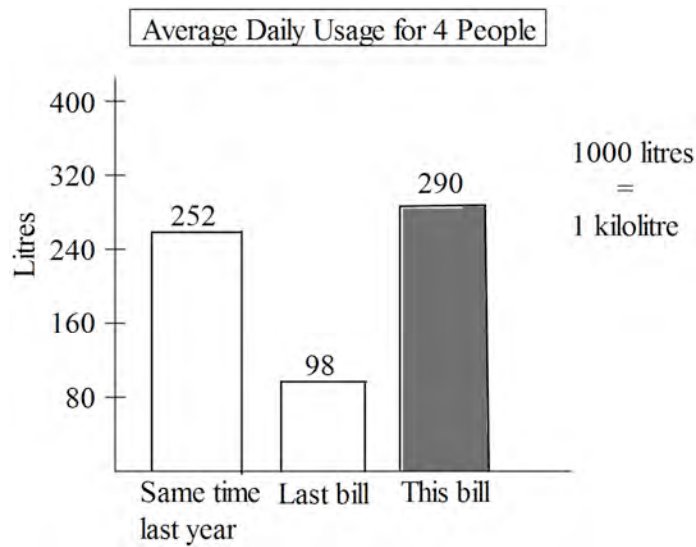
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Question 28 (15 marks)

- (a) A human hair is typically 0.005 mm in diameter. 1
Express this diameter in scientific notation in mm.

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- (b) The average daily water usage for a household of four people is shown below.
The bill covers the period from 01/04/14 to 30/06/14.



- (i) What was the average daily usage per person per day during this billing period? 1

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- (ii) How many kilolitres of water did the household use for this billing period? 1

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- (iii) If water is \$2.4100 per kilolitre, what was the cost of the water for this billing period? 1

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- (c) Xin Yi uses Star Plan for her satellite phone. The costs of a call are \$4 connection fee plus \$3 per minute.

(i) Complete the table for Star Plan

2

Length of call, t minutes	1	2	8
Cost of call, \$C	7		

(ii) Find the equation of the linear function relating C to t for Star Plan.

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(iii) Another plan, Universal Plan, has a cost function $C = 2t + 10$, where C is the cost in Dollars and t is the length of a call in minutes.

By using simultaneous equations and the two functions for Star Plan and Universal, calculate the break even cost of both plans.

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- (d) Squeaky Clean windows can clean all windows of a building in 5 days when it uses a team of 8 people. This year the client wants the job completed in 4 days.

Use an inverse variation function to find how many cleaners are required to complete the job in 4 days.

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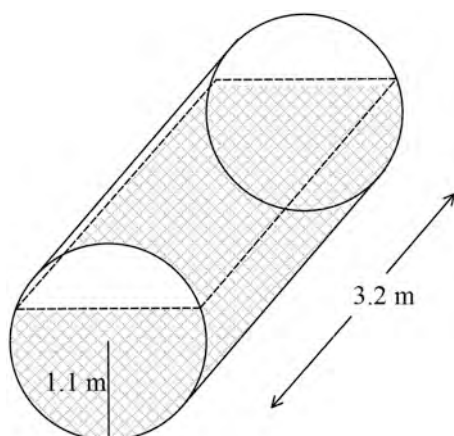
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- (e) A cylindrical tank lying on its side is 75% full of water. The tank has a radius of 1.1 m and a height of 3.2 m.



Calculate the volume of water in the tank, correct to the nearest m^3 .

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Mathematics General 2

STUDENT NAME.....

TEACHERS NAME.....

Section II

Question 29 (15 marks)

Allow about 23 minutes for this question.

Answer the questions in the spaces provided.

Your responses should include relevant mathematical reasoning and/or calculations.

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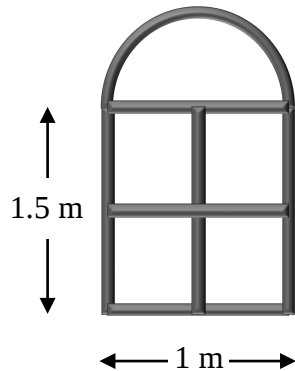
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Question 29 (15 marks)

- (a) The window frame below consists of four rectangles and a semi-circle.



Calculate the length of wood required to construct the frame.
Give your answer correct to 1 decimal place.

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- (b) A survey of a team of Softball players asked which hand they batted with and which hand they threw with. The results are recorded in a table.

	Bat right-handed	Bat Left-handed
Throw right-handed	84	16
Throw left-handed	11	89

- (i) What percentage of Softball players bat and throw with the same hand?

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- (ii) What fraction of players who bat left-handed throw with their right hand?

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- (c) A local business was making T-shirts. The profit ($\$P$) made on the T-shirts can be calculated using the formula $P = \frac{5}{4}n - 650$ where n is the number of T-shirts sold.

- (i) Calculate the number of t-shirts sold if a profit of \$10 875 was made. 1

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- (ii) The gradient of this line is $\frac{5}{4}$. What does this represent in this context? 1

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- (d) Holly is an experienced driver who has a reaction time of 1.2 seconds.
She is travelling at 95.7 km/h when she applies her brakes, and she stops after 75.9 m.

- (i) In using the formula $d = kv^2$, d is the braking distance in metres, 2
and v km/h is the initial speed of the car when applying the brakes.
Use the given information to calculate the value of k , to 2 significant figures.

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- (ii) Calculate Holly's braking distance (d), when travelling at 63.4 km/h, 1
to the nearest metre.

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- (iii) Calculate Holly's reaction distance at 63.4 km/h to the nearest metre. 2

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- (iv) Find Holly's total stopping distance to the nearest metre. 1

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- (v) On another occasion, Holly's braking distance was 90m. 2
How fast was she travelling, to the nearest km/h?

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Section II Extra writing space

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Mathematics General 2

STUDENT NAME.....

TEACHERS NAME.....

Section II

Question 30 (15 marks)

Allow about 23 minutes for this question.

Answer the questions in the spaces provided.

Your responses should include relevant mathematical reasoning and/or calculations.

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Question 30 (15 marks)

(a) A table of future value interest factors is shown:

Period	Interest rate per period				
	1%	2%	3%	4%	5%
1	1.000	1.000	1.000	1.000	1.000
2	2.010	2.020	2.030	2.040	2.050
3	3.030	3.060	3.091	3.122	3.153
4	4.060	4.122	4.184	4.246	4.310
5	5.101	5.204	5.309	5.416	5.526
6	6.152	6.308	6.468	6.633	6.802
7	7.214	7.434	7.662	7.898	8.142
8	8.286	8.583	8.892	9.214	9.549
9	9.369	9.755	10.159	10.583	11.027
10	10.462	10.950	11.464	12.006	12.578

Siobhan starts an annuity that involves making equal contributions of \$500 per quarter for 2 years at an interest rate of 8% p.a.

(i) Use the above table to find the future value of the annuity. 2

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(ii) Calculate the total interest earned on the annuity. 1

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(iii) What single amount would Siobhan have to invest now to achieve the same future value? 2

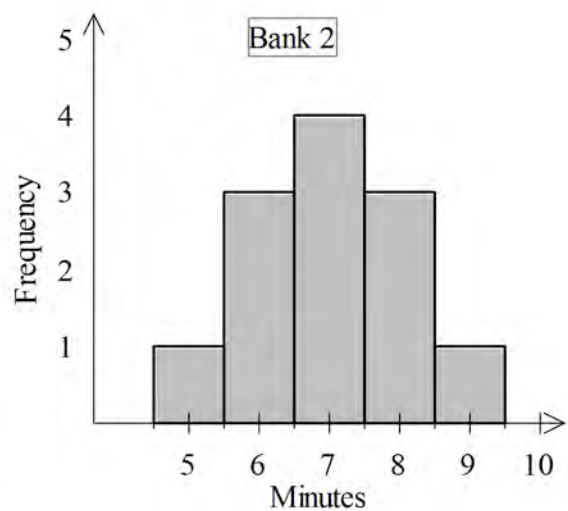
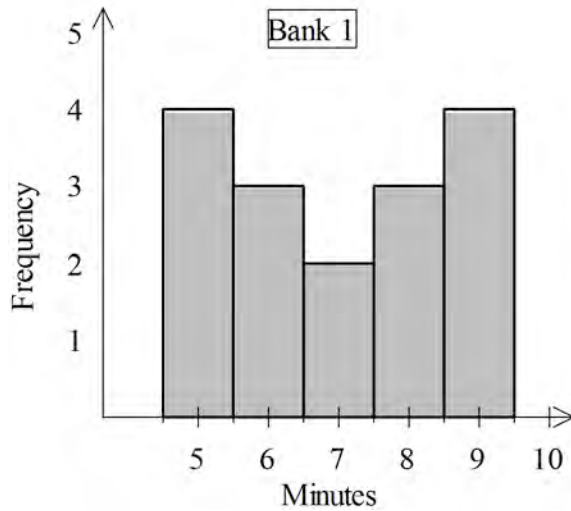
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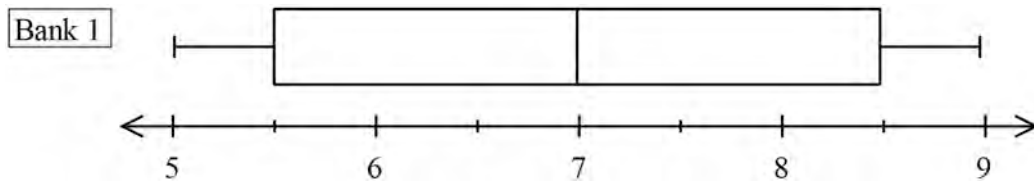
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- (b) The waiting time, in minutes, recorded by customers at two different banks are shown below. Both histograms have the same scale on the frequency axis and the same scores on the horizontal axis.

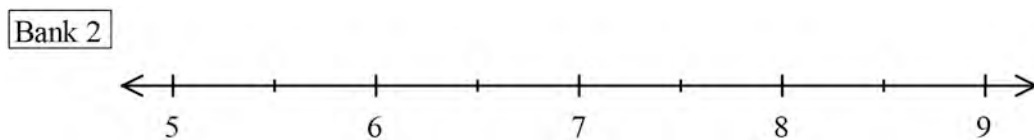


A box and whisker plot of Bank 1 is drawn below.

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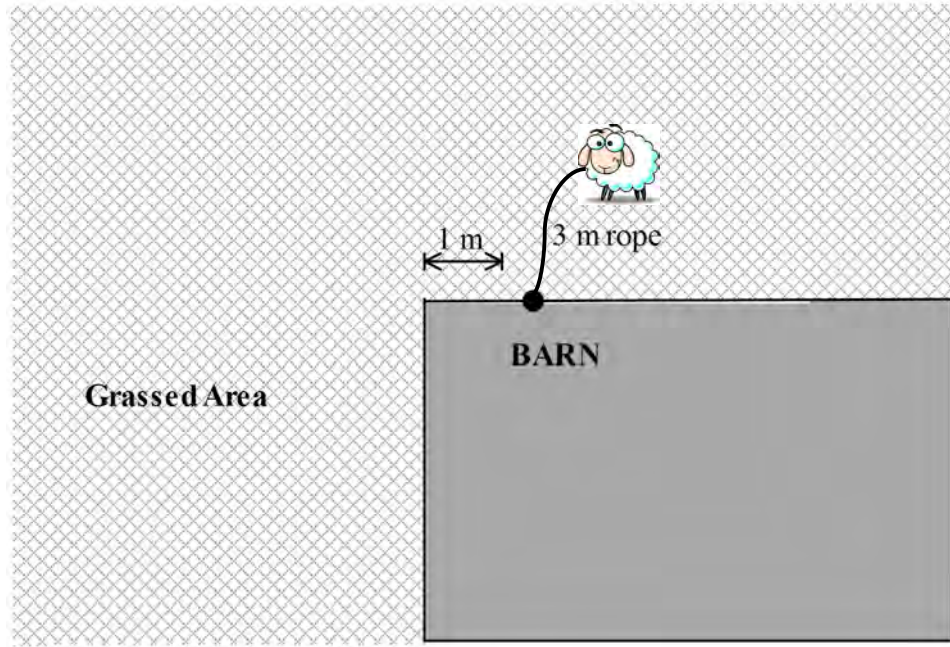


In the space provided, draw a box and whisker plot of Bank 2 using the same axis.



- (c) A sheep is tethered to the wall of a barn one metre from the corner of the barn. The length of the sheep's rope is 3 m.

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Find the area of grass upon which the sheep can graze.

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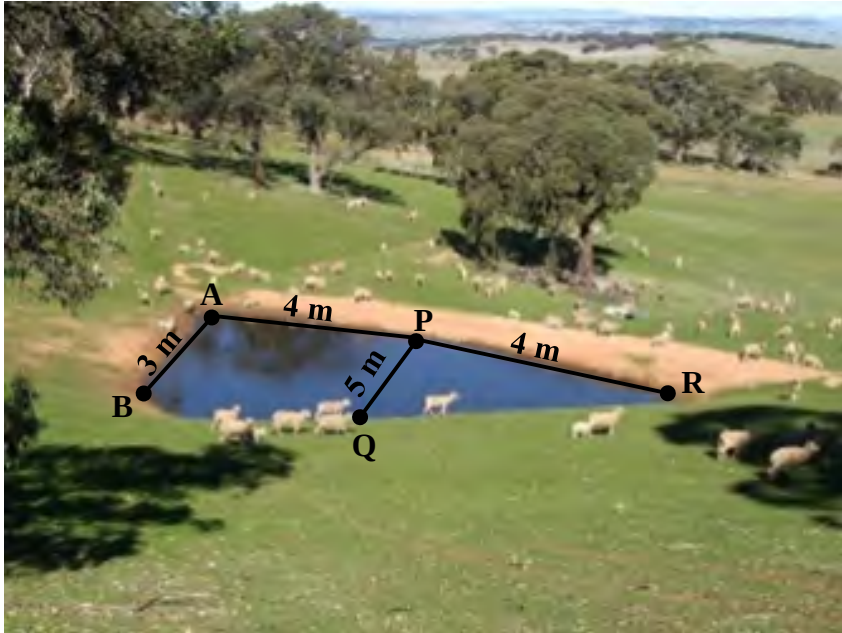
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- (d) Winkle took three measurements at 4-metre intervals across an irregular shaped dam on her farm, as shown on the diagram. She measured the depth of water at each of the intervals, and the measurements were 9 m at AB and 12 m at PQ.

Use Simpson's rule to estimate the capacity of water in the dam, to the nearest litre.

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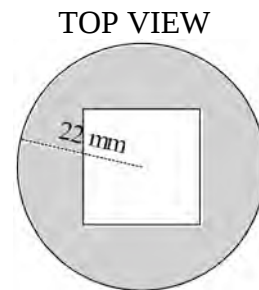
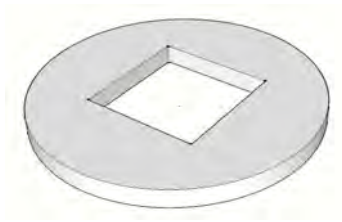
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- (e) A new coin is being produced, featuring a circular design with a square hole cut out of it. The coin has a radius of 22 mm and a thickness of 3 mm.



To achieve the desired weight, the coin must have a volume of 4400 mm^3 .

Calculate the dimensions of the square that will result in this volume, in millimetres, correct to 3 significant figures.

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End of Paper

Section II Extra writing space

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

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Mr Dudley ✓
Mrs Gibbons
Mr Morrison ✓
Mrs Munro ✓
Ms Stott

Name: Solutions

Teacher:



Pymble Ladies' College

HIGHER SCHOOL CERTIFICATE

TRIAL EXAMINATION

2015

Mathematics General 2

General Instructions

- Reading time – 5 minutes.
- Working time – $2\frac{1}{2}$ hours.
- Use pencil for Questions 1-25
- Write using black or blue pen. Black pen is preferred.
- Board approved calculators may be used.
- A formulae and data sheet is provided.
- In Questions 26-30, show relevant mathematical reasoning and/or calculations.

Total Marks – 100

Section I Pages 1-10

25 marks

- Attempt all Questions 1-25
- Allow about 35 mins for this section

Section II Pages 11-45

75 marks

- Attempt Questions 26-30
- Allow about 1 hour and 55 minutes for this section.

Mark	/100
Highest Mark	/100
Rank	

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 The following question was used to survey people's views on watching television:
"I like to watch the news." Place a cross on the line to indicate your opinion of this statement.

Strongly Agree _____ Strongly Disagree

What could the response required for this question can be classified as?

- (A) Categorical, nominal.
 - ☒ (B) Categorical, ordinal.
 - (C) Quantitative, continuous.
 - (D) Quantitative, discrete.
- 2 Which of the following types of motor insurances is compulsory in Australia?
- (A) Comprehensive insurance
 - (B) Third Party Property insurance
 - ☒ (C) Third Party Personal insurance
 - (D) None of the above
- 3 Hugo's phone calls are charged at 9 cents for each 20 seconds or part thereof.
- What is the cost of a 5 minute call?
- (A) 49.5 c
 - ☒ (B) \$1.35
 - (C) \$3.30
 - (D) \$9.90

4 Which pair of simultaneous equations has the solution $x = -5$, $y = 3$?

(A) $y = x + 8$, $4x - 3y = 29$

(B) $y - x = 8$, $4x - 3y = 26$

☒ (C) $y = x + 8$, $3x - 2y = -21$

(D) $x + y = 2$, $5x + y = -22$

5 Caprice buys a car for \$22 000. It depreciates at a rate of 5% per year.

Which of the following best describes its value, S dollars, at the end of two years?

(A) $S = 22000(1 + 0.05)^2$

☒ (B) $S = 22000(1 - 0.05)^2$

(C) $S = 22000 \times 0.05 \times 2$

(D) $S = 22000 - 20000 \times 0.05 \times 2$

6 In a science test, a class of 24 boys had a mean of 56 and a class of 16 girls had a mean of 66.

What is the combined mean of the two classes?

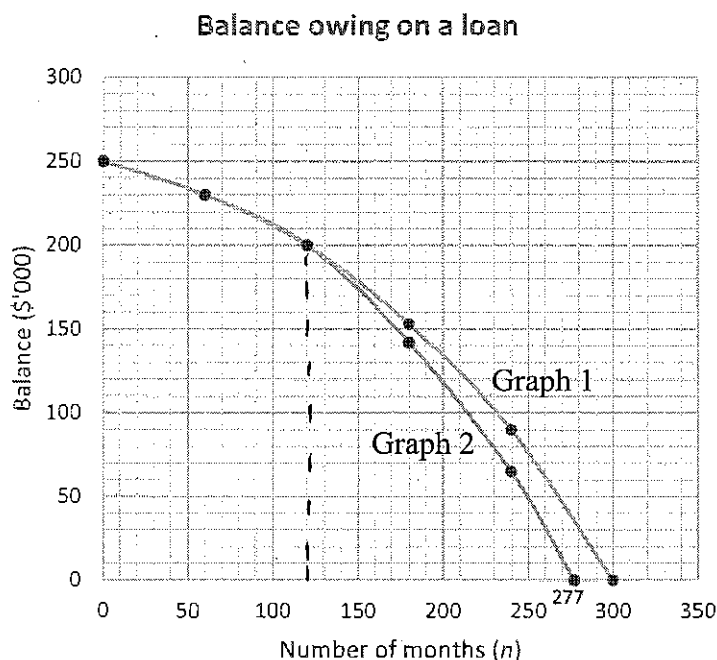
(A) 61

(B) 56

☒ (C) 60

(D) 62

- 7 Questions 7 and 8 refer to the graph below.



Graph 1 shows the balance owing on a loan of \$250 000 at 7.2% p.a. compounding monthly over 25 years. The monthly repayment is \$1799. Graph 2 shows the balance if the borrower starts paying an extra \$100 each month after 120 months.

According to the graphs, for how many months was the extra \$100 paid?

- (A) 120
 (B) 157
 (C) 180
 (D) 277
- 8 What is the total cost of the loan if the borrower uses graph 2 with the extra \$100 monthly payments?
- (A) \$514 023
 (B) \$569 700
 (C) \$526 023
 (D) \$498 323

- 9 A flash-drive can store 64GB of memory. How many files with an average size of 2MB can be stored on the flash drive?

(A) 32
(B) 3200
(C) 32000
(D) 32768

- 10 Expand and simplify $5x^2(x^2 - 1) - 2x^2$.

(A) $5x^4 - 2x^2 - 1$
(B) $5x^4 + 7x^2$
(C) $5x^4 - 7x^2$
(D) $8x^2$

- 11 Maxine's gross earnings last year were \$59 000 and she had taxable deductions of \$2200. The Medicare levy is 1.5% of the taxable income.

What is the Medicare levy paid by Maxine?

(A) \$612
(B) \$852
(C) \$885
(D) \$918

- 12 A group of 5 friends want to take a selfie with just three girls. How many different groups of three are possible?

(A) 5
(B) 6
☒ (C) 10
(D) 60

- 13 Which calculation is used to convert 1.4MB to kilobits?

(A) $1.4 \times 1000^2 \div 8 \div 1024^2$
(B) $1.4 \times 1000^2 \times 8 \div 1024^2$
☒ (C) $1.4 \times 1024^2 \times 8 \div 1000$
(D) $1.4 \times 1024^2 \div 8 \div 1000$

- 14 For the data set below, which statement is correct?

25, 45, 64, 48, 66, 85, 45, 27

(A) The sample standard deviation is 20.29 (to 2 decimal places)
(B) The mean is 50.625.
(C) The population standard deviation is 18.98 (to 2 decimal places)
☒ (D) All of the above

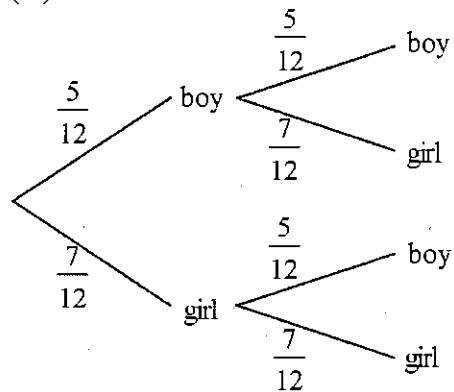
- 15 Minyi borrows \$12 500 for a term of 6 years at a flat rate of 8.25% p.a. The loan including interest is paid back in equal monthly installments.
What is the amount of the monthly repayment?

☒ (A) \$259.55
(B) \$3114.58
(C) \$6187.50
(D) \$18687.50

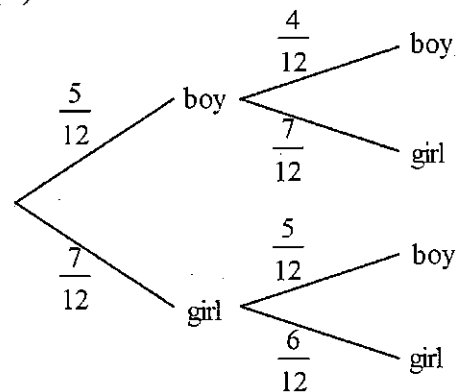
- 16 From 5 boys and 7 girls, two children are chosen at random to work together on a project.

Which of the following probability trees could be used to determine the probability of choosing a boy and a girl?

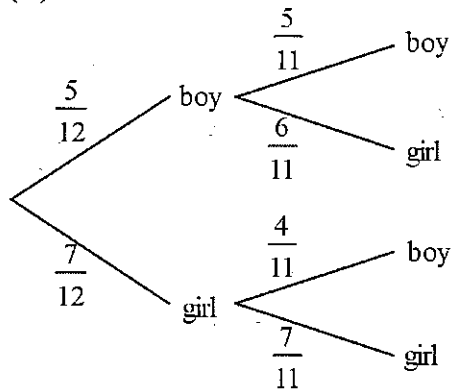
(A)



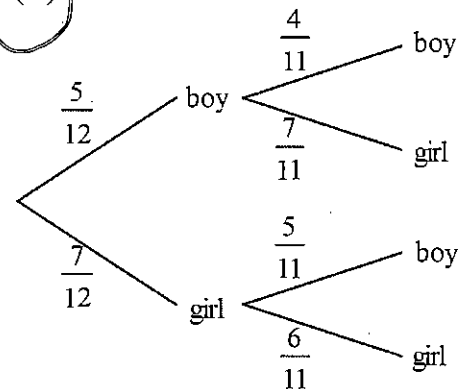
(B)



(C)



(D)

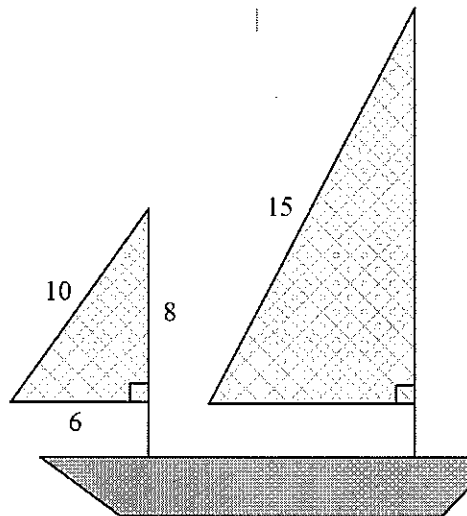


- 17 A certain brand of pain relief tablets contain 500 mg of Paracetamol. For adults, it is recommended that no more than 8 tablets are taken in a 24 hour period.

What is the maximum amount of Paracetamol that an adult should ingest in a 24 hour period?

- (A) 4 g
(B) 62.5 g
(C) 167 g
(D) 4000 g

- 18 A model boat has 2 triangular sails which are similar to each other. The dimensions are shown in cm.



What is the total area of both sails?

- (A) 24 cm^2
(B) 72 cm^2
(C) 78 cm^2
(D) 95.5 cm^2
- 19 A password must have 3 digits with no repeats.
- How many 3-digit passwords are greater than 600?
- (A) 288
(B) 360
(C) 400
(D) 504
- 20 During the April storm in Sydney, 110mm of rain fell on Wahroonga which has an area of 12 km^2 .
- What is the approximate volume of water that this represents?
- (A) $110 \times 12 \text{ m}^3$
(B) $0.11 \times 12\,000 \text{ m}^3$
(C) $0.11 \times 12\,000\,000 \text{ m}^3$
(D) $0.000\,11 \times 12\,000\,000 \text{ m}^3$

- 21 A sample of 2 computer chips is selected without replacement from a batch of 15 computer chips. It is known that 6 of the computer chips are defective.

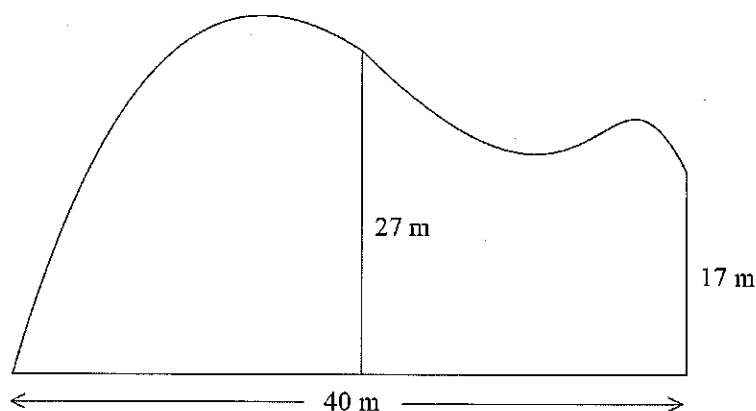
What is the probability that only one of the selected computer chips is defective?

- (A) $\frac{6}{15}$
 (B) $\frac{9}{35}$
 (C) $\frac{18}{35}$
 (D) $\frac{9}{15}$

- 22 When r is made the subject of $v = \sqrt{\frac{mr}{2\pi}}$ then $r =$

- (A) $\frac{4\pi^2 v^2}{m^2}$
 (B) $\frac{2\pi v^2}{m}$
 (C) $\frac{2\pi v^2}{m^2}$
 (D) $\frac{2\pi v}{m}$

- 23 Which expression would correctly estimate the area in the diagram using one application of Simpson's Rule?



- (A) $\frac{40}{3}(27+17) \text{ m}^2$
 (B) $\frac{40}{3}(4 \times 27 + 17) \text{ m}^2$
 (C) $\frac{20}{3}(27+17) \text{ m}^2$
 (D) $\frac{20}{3}(4 \times 27 + 17) \text{ m}^2$

- 24 Which of the following best describes the cost in dollars of running a 3600-watt (3.6 kW) air conditioner for 4 hours per day for 31 days if the cost of electricity is \$0.22/kWh?

(A) $3.6 \times 4 \times 31 \times 0.22$
(B) $3600 \times 4 \times 31 \times 0.22$
(C) $3.6 \times 4 \times 31$
(D) $3600 \times 4 \times 31$

- 25 The volume of a sphere increases as the cube of its radius. The radius is increased by 20%. What is the increase in volume?

Volume of a sphere $= \frac{4}{3} \pi r^3$.

(A) 0.002%
(B) 20%
(C) 17.28%
(D) 72.8%

Question 26 (15 marks)

- (a) If $a = 8b^3 - 10$, find the value of b when a is 17.

1

$$17 = 8b^3 - 10$$

$$27 = 8b^3$$

$$b^3 = \frac{27}{8}$$

$$b = \sqrt[3]{\frac{27}{8}}$$

$$b = \frac{3}{2}$$

- (b) The formula for drip rate for a certain medication is:

$$\text{Drops per minute} = \frac{\text{total volume to be given (in mL)}}{\text{time (in minutes)}} \times \text{drop factor}$$

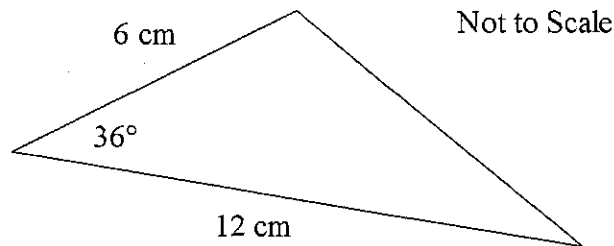
A patient requires 1200 mL of medication over a 10 hour period.

2

If the drop factor is 30, calculate the drip rate in drops per minute.

$$\begin{aligned} \text{drops per min} &= \frac{1200 \text{ mL}}{10 \times 60} \times 30 \\ &= \frac{1200}{600} \times 3 \\ &= 60 \end{aligned}$$

(c)



(i) Calculate the area of the triangle. Answer to 1 decimal place.

2

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

$$= \frac{1}{2} \times 6 \times 12 \times \sin 36$$

$$= 21.16026...$$

$$= \boxed{21.2 \text{ cm}^2 \text{ (to 1 dp)}}$$

(ii) Calculate the perimeter of the triangle correct to 1 decimal place.

3

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$a^2 = 6^2 + 12^2 - 2 \times 6 \times 12 \times \cos 36$$

$$a^2 = 63.50159...$$

$$\therefore a = 7.968786157...$$

$$\therefore \text{perimeter} = 6 + 12 + a$$

$$= 25.968786...$$

$$= \boxed{26.0 \text{ cm}}$$

- (e) The back to back stem and leaf plot shows the ages of 25 male and 25 female actors when they received their award for Best Actor or Best Actress.

Actors (male)	Stem	Actors (female)
	2	1 4 6 6 6
9 8 7 5 3 2 1	3	0 0 1 1 3 3 4 4 4 5 7
8 8 7 7 6 4 3 3 2 2 1 0	4	1 1 1 1 9
6 5 1	5	
2 0	6	0 1
6	7	5
	8	0

- (i) What is the median age of each group?

2

median male = 43
median female = 34

- (ii) What do the median ages tell us about the awards for best male and female actors?

1

female actors tend to receive best actor/actress awards younger than male actors (or equivalent response)

- (iii) Describe the skewness of the data for the male actors.

1

positively skewed

- (iv) Does the highest score in the female actors qualify as an outlier?

3

Support your answer with mathematical calculations.

$Q_u = 41$ ① $Q_L = 30 \therefore IQR = 11$
outlier $> Q_3 + 1.5 \times IQR$ ①
 $> 41 + 1.5 \times 11$
 > 57.5

since 80 is greater than 57.5, it
is an outlier ①

Question 27 (15 marks)

(a) A 10 year term deposit offers an interest rate of 6% p.a. compound monthly.

(i) What is the future value of an investment of \$5000?

2

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

$$= 5000 \left(1 + \frac{0.06}{12}\right)^{120}$$

$$FV = 9096.98367$$

$$FV = \$9096.98$$

(ii) What single amount must be invested now to ensure a future value of \$12 000?

1

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{12,000}{\left(1 + \frac{0.06}{12}\right)^{120}}$$

$$PV = 6595.5928$$

$$= \$6595.59$$

(b) Bella's car uses 6.3L/100km.

(i) How much petrol does she use to travel 1375km from Sydney to Adelaide?
Answer to 1 decimal place.

1

$$\frac{x}{6.3L/100km} = \frac{1375km}{1}$$

$$\therefore x = \frac{1375}{100} \times 6.3$$

$$\therefore \text{fuel used} = 86.625L$$

$$= 86.6L$$

(ii) Petrol cost \$1.20 /L. How far, to the nearest kilometre, can she travel on \$75?

1

$$\text{litres used} = \frac{\$75}{\$1.20}$$

$$= 62.5L$$

$$\frac{62.5L}{6.3L/100} = x$$

$$\therefore \text{distance} = \frac{62.5 \times 100}{6.3}$$

$$= 992.0634 \dots$$

$$= 992 \text{ km (nearest km)}$$

- (c) On 15th March 2015, Dilnoor bought a digital camera costing \$1600 using a credit card. Simple interest was charged at a rate of 21.35% per annum for purchases. There is no interest-free period.

The period for which interest was charged included the date of purchase and the date of payment. Dilnoor made no other purchases on her card.

What amount was paid when the account was paid in full on 20th April 2015?

3

$$\begin{aligned} & \text{Amount paid in full} \quad \textcircled{1} \\ & = \$1600 + \left(\$1600 \times \frac{0.2135}{365} \times (17+20) \text{ days} \right) \quad \textcircled{1} \\ & = \$1600 + \$34.6279... \quad \textcircled{1} \\ & = \$1634.6279... \\ & = \$1634.63 \end{aligned}$$

- (d) Casual employees at the Café Olé are paid \$14 per hour. They earn time-and-a-half on Saturdays and double time on Sundays.

The timesheet for a given week is shown below.

Café Olé casual employee time sheet								
Name		MON	TUE	WED	THU	FRI	SAT	SUN
Nathan	Start	0800		1100			0900	
	Finish	1400		1900			1500	
Jamie	Start		1200	1000	1200			
	Finish		2200	1600	2000			
Indira	Start					1000	1200	1000
	Finish					1500	2000	1600

- (i) How many hours did Jamie work this week?

1

$$\text{Jamie's hours} = 10 + 6 + 8$$

$$= \boxed{24 \text{ hrs}}$$

- (ii) How many extra hours must Jamie work on a Saturday to earn \$441 in a week?

2

$$\begin{aligned} \$441 &= (24 \text{ hrs} \times \$14) + (x \times 1.5 \times \$14) \quad \textcircled{1} \\ 441 &= 336 + 21x \\ 21x &= 105 \quad \textcircled{1} \\ x &= 5 \quad \therefore \text{Needs to work } \boxed{5 \text{ hrs}} \end{aligned}$$

- (iii) Calculate Indira's total earnings for the week.

①

$$\begin{aligned} \text{earnings} &= (5 \times \$14) + (8 \times 1.5 \times \$14) + (6 \times 2 \times \$14) \quad \textcircled{1} \quad 2 \\ &= 70 + 168 + 168 \\ &= \boxed{\$406} \end{aligned}$$

- (e) Helena recorded the number of births at a hospital over the period of a week.

Outcome	Frequency
Number of girls born	144
Number of boys born	156

- (i) What is the relative frequency of a girl being born?

1

rel freq girl = $\frac{144}{300} = \frac{12}{25}$

- (ii) Over a period of 4 weeks there were 850 children born at the hospital. Helena calculated that the number of girls born should be 408.

Is her calculation correct or not?

1

Justify your answer with mathematical calculations.

estimated girls born
 $= 850 \times \frac{144}{300}$
 $= 408 \text{ girls}$
 $\therefore \text{Helena's calculation is correct.}$

} both needed

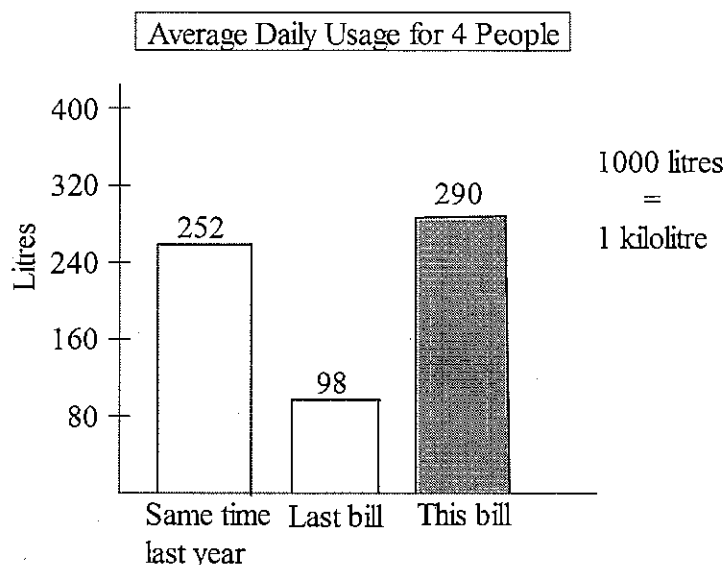
Question 28 (15 marks)

- (a) A human hair is typically 0.005 mm in diameter.
Express this diameter in scientific notation in mm.

1

$$0.005 \text{ mm} = 5 \times 10^{-3} \text{ mm}$$

- (b) The average daily water usage for a household of four people is shown below.
The bill covers the period from 01/04/14 to 30/06/14.



- (i) What was the average daily usage per person per day during this billing period?

1

$$\text{daily av. usage per p} = \frac{290}{4} = 72.5 \text{ L/person}$$

- (ii) How many kilolitres of water did the household use for this billing period?

1

$$\begin{aligned} \text{usage} &= 290 \text{ L} \times (30 + 31 + 30) \\ &= 26390 \text{ L} \\ &= 26.39 \text{ KL} \end{aligned}$$

- (iii) If water is \$2.4100 per kilolitre, what was the cost of the water for this billing period?

1

$$\begin{aligned} \text{cost} &= 26.39 \text{ KL} \times \$2.4100 \\ &= \$63.5999 \\ &= \$63.60 \end{aligned}$$

- (c) Xin Yi uses Star Plan for her satellite phone. The costs of a call are \$4 connection fee plus \$3 per minute.

(i) Complete the table for Star Plan

2

Length of call, t minutes	1	2	8
Cost of call, \$ C	7	10	28

(ii) Find the equation of the linear function relating C to t for Star Plan.

2

$$\begin{array}{l}
 m = \frac{10-7}{2-1} \\
 m = 3 \\
 \therefore C = 3t + b
 \end{array}
 \quad
 \begin{array}{l}
 \text{sub } (1, 7) \\
 7 = 3(1) + b \\
 b = 4
 \end{array}
 \quad
 \therefore C = 3t + 4$$

(iii) Another plan, Universal Plan, has a cost function $C = 2t + 10$, where C is the cost in Dollars and t is the length of a call in minutes.

By using simultaneous equations and the two functions for Star Plan and Universal, calculate the break even cost of both plans.

3

$$\begin{array}{l}
 C = 3t + 4 \quad \text{--- ①} \\
 C = 2t + 10 \quad \text{--- ②}
 \end{array}$$

(or by elimination)

$$\begin{array}{l}
 \text{sub ①} \rightarrow \text{②} \quad 3t + 4 = 2t + 10 \\
 \quad \quad \quad t = 6 \quad \quad \quad \text{①} \\
 \therefore C = 3(6) + 4 \quad \quad \quad \text{①} \\
 \quad \quad \quad = 22 \\
 \therefore \text{break even cost} = \$22 \quad \quad \quad \text{①}
 \end{array}$$

- (d) Squeaky Clean windows can clean all windows of a building in 5 days when it uses a team of 8 people. This year the client wants the job completed in 4 days.

Use an inverse variation function to find how many cleaners are required to complete the job in 4 days.

2

let D be days, $P = \text{n}^\circ \text{ of people}$

$$D \propto \frac{1}{P}$$

$$D = \frac{k}{P}$$

$$5 = \frac{k}{8}$$

$$k = 40$$

$$D = \frac{40}{P} \quad (1)$$

when $D = 4$

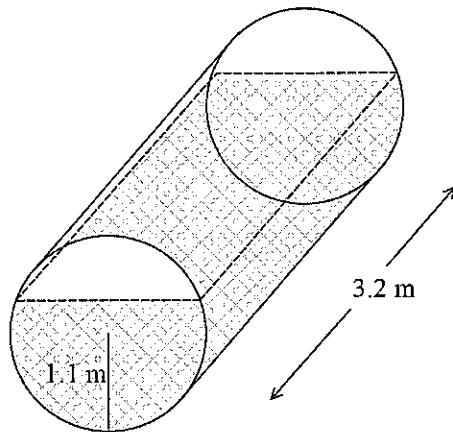
$$4 = \frac{40}{P}$$

$$P = 10$$

must have
inverse function

It takes 10 cleaners

- (e) A cylindrical tank lying on its side is 75% full of water. The tank has a radius of 1.1 m and a height of 3.2 m.



Calculate the volume of water in the tank, correct to the nearest m^3 .

2

$$V = 0.75 \times \pi r^2 H$$

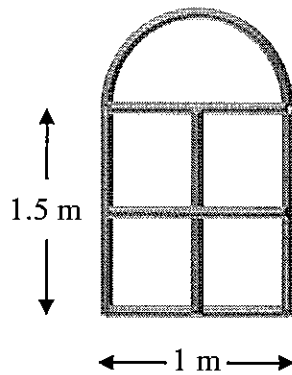
$$= 0.75 \times \pi \times 1.1^2 \times 3.2 \quad (1)$$

$$= 9.123185 \dots$$

$$= 9 \text{ m}^3 \text{ (to nearest m}^3\text{)} \quad (1)$$

Question 29 (15 marks)

- (a) The window frame below consists of four rectangles and a semi-circle.



Calculate the length of wood required to construct the frame.
Give your answer correct to 1 decimal place.

2

$$\begin{aligned}
 \text{wood req'd} &= (3 \times 1\text{m}) + (3 \times 1.5\text{m}) + \frac{1}{2} (2\pi \times 0.5) \\
 &= 3 + 4.5 + \frac{\pi}{2} \\
 &= 9.07079\dots \\
 &= \boxed{9.1\text{ m (to 1 dp)}}
 \end{aligned}$$

- (b) A survey of a team of Softball players asked which hand they batted with and which hand they threw with. The results are recorded in a table.

	Bat right-handed	Bat Left-handed
Throw right-handed	84	16
Throw left-handed	11	89

- (i) What percentage of Softball players bat and throw with the same hand?

2

$$\begin{aligned}
 \% \text{ bat same hand} &= \frac{84 + 89}{200} \times 100 \\
 &= \boxed{86.5\%}
 \end{aligned}$$

- (ii) What fraction of players who bat left-handed throw with their right hand?

1

$$\begin{aligned}
 \text{fraction} &= \frac{16}{16 + 89} \\
 &= \boxed{\frac{16}{105}}
 \end{aligned}$$

- (c) A local business was making T-shirts. The profit (\$P) made on the T-shirts can be calculated using the formula $P = \frac{5}{4}n - 650$ where n is the number of T-shirts sold.

(i) Calculate the number of t-shirts sold if a profit of \$10 875 was made.

1

$$P = \frac{5}{4}n - 650$$

$$10875 = \frac{5}{4}n - 650$$

$$11525 = \frac{5n}{4}$$

$$5n = 46100$$

$$n = 9220$$

$\therefore$ Sold 9220 T-shirts

(ii) The gradient of this line is $\frac{5}{4}$. What does this represent in this context?

1

rate of change of Profit with number of t-shirts sold /

represents a profit of \$1.25 per t-shirt

- (d) Holly is an experienced driver who has a reaction time of 1.2 seconds. She is travelling at 95.7 km/h when she applies her brakes, and she stops after 75.9 m.

- (i) In using the formula $d = kv^2$, d is the braking distance in metres, and v km/h is the initial speed of the car when applying the brakes. Use the given information to calculate the value of k , to 2 significant figures.

$$d = kv^2$$

$$75.9 = k \times 95.7^2$$

$$k = \frac{75.9}{95.7^2}$$

$$k = 0.0082873923$$

$$k = 0.0083 \text{ (to 2 sf)}$$

- (ii) Calculate Holly's braking distance (d), when travelling at 63.4 km/h, to the nearest metre.

$$d = kv^2$$

$$= 0.00828... \times 63.4^2$$

$$= 33.31167081$$

$$= 33 \text{ m (to n m)}$$

- (iii) Calculate Holly's reaction distance at 63.4 km/h to the nearest metre.

$$\text{speed} = 63.4 \text{ km/hr}$$

$$= 63.4 \div 3.6 \text{ m/s}$$

$$= 17.611... \text{ m/s}$$

$$\therefore \text{react dis} = 17.611... \times 1.2$$

$$= 21.13 \text{ m}$$

$$= 21 \text{ m (to n m)}$$

- (iv) Find Holly's total stopping distance to the nearest metre.

$$\text{stopping dist} = 33.3116... + 21.13$$

$$= 54.44500414 \text{ m}$$

$$= 54 \text{ m (to n m)}$$

- (v) On another occasion, Holly's braking distance was 90m. How fast was she travelling, to the nearest km/h?

$$d = kv^2$$

$$90 = 0.00828... \times v^2$$

$$v^2 = \frac{90}{0.00828...}$$

$$v = 104.2106983...$$

$$v = 104 \text{ km/hr (to n km/hr)}$$

Question 30 (15 marks)

(a) A table of future value interest factors is shown:

Period	Interest rate per period				
	1%	2%	3%	4%	5%
1	1.000	1.000	1.000	1.000	1.000
2	2.010	2.020	2.030	2.040	2.050
3	3.030	3.060	3.091	3.122	3.153
4	4.060	4.122	4.184	4.246	4.310
5	5.101	5.204	5.309	5.416	5.526
6	6.152	6.308	6.468	6.633	6.802
7	7.214	7.434	7.662	7.898	8.142
8	8.286	8.583	8.892	9.214	9.549
9	9.369	9.755	10.159	10.583	11.027
10	10.462	10.950	11.464	12.006	12.578

8 quarters

Siobhan starts an annuity that involves making equal contributions of \$500 per quarter for 2 years at an interest rate of 8% p.a. — 2% per quarter

(i) Use the above table to find the future value of the annuity.

2

$$FV = M \times (\text{interest factor})$$

$$= \$500 \times 8.583$$

$$= \$4291.50$$

(ii) Calculate the total interest earned on the annuity.

1

$$\text{Interest} = FV - \text{total contributions}$$

$$= \$4291.50 - (\$500 \times 8)$$

$$= \$291$$

(iii) What single amount would Siobhan have to invest now to achieve the same future value?

2

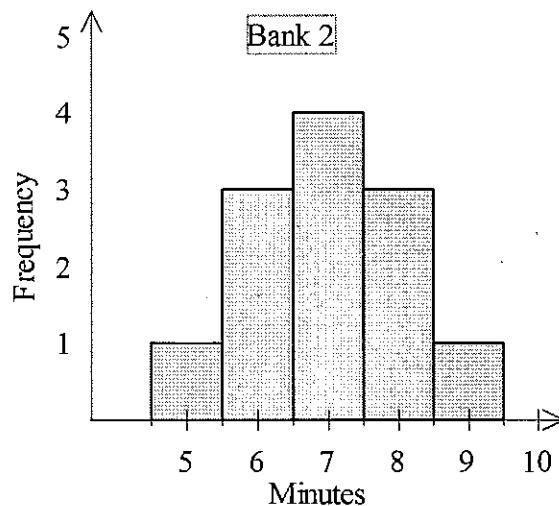
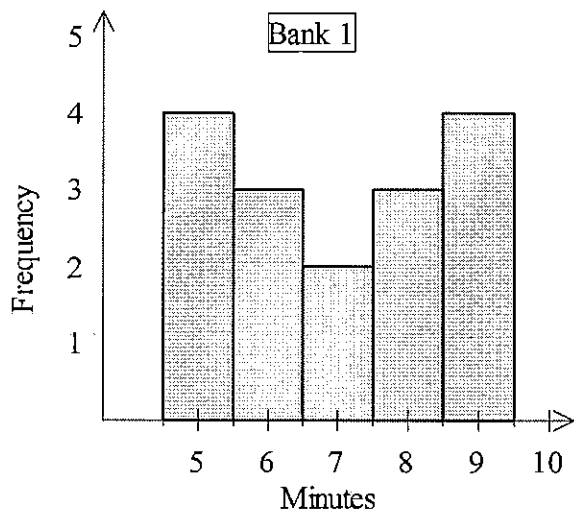
$$PV = \frac{FV}{(1+r)^n}$$

$$PV = \frac{4291.50}{(1 + \frac{0.08}{4})^8}$$

$$PV = 3662.7539...$$

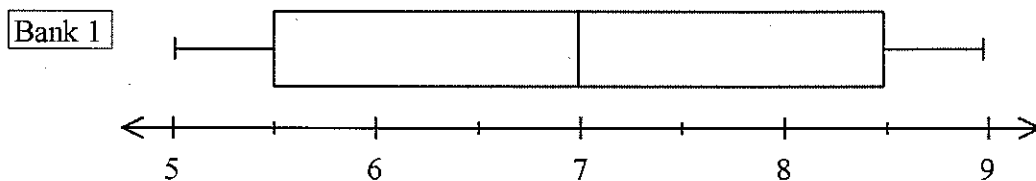
$$PV = \$3662.75$$

- (b) The waiting time, in minutes, recorded by customers at two different banks are shown below. Both histograms have the same scale on the frequency axis and the same scores on the horizontal axis.

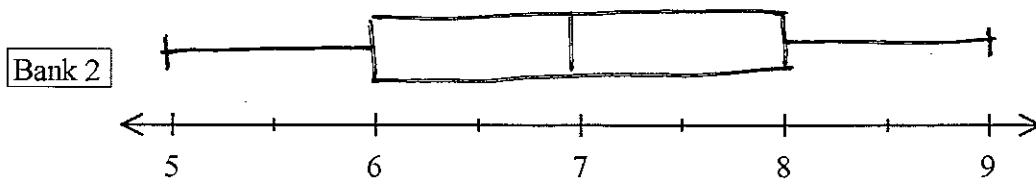


A box and whisker plot of Bank 1 is drawn below.

2

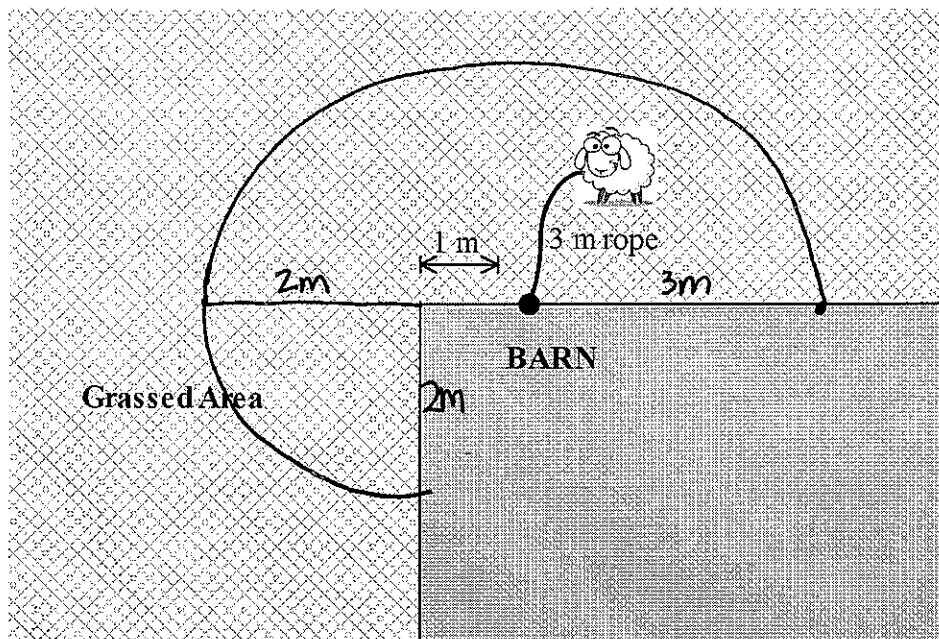


In the space provided, draw a box and whisker plot of Bank 2 using the same axis.



- (c) A sheep is tethered to the wall of a barn one metre from the corner of the barn. The length of the sheep's rope is 3 m.

2



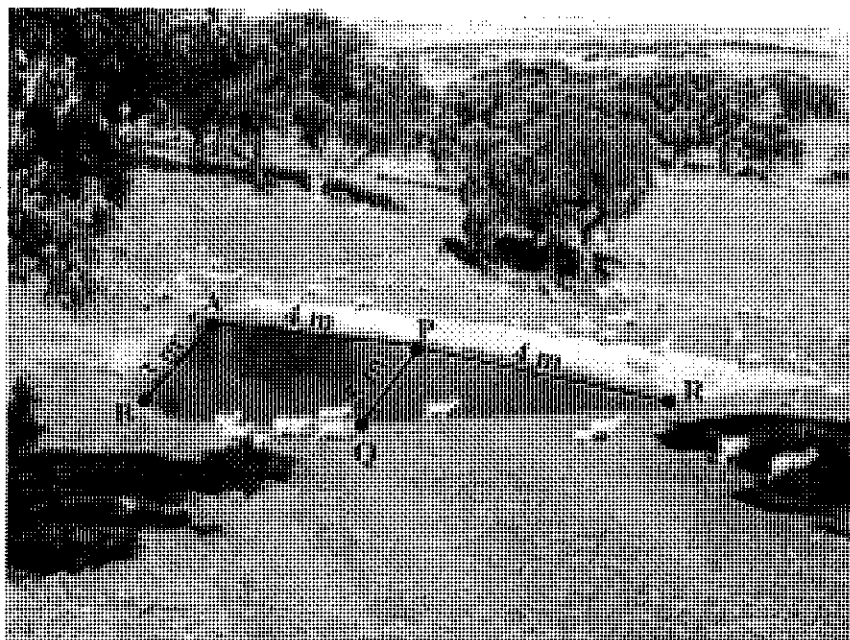
Find the area of grass upon which the sheep can graze.

$$\begin{aligned}
 \text{Grazing area} &= \frac{1}{2}(\pi R^2) + \frac{1}{4}(\pi r^2) \\
 &= \frac{1}{2} \times \pi \times 3^2 + \frac{1}{4} \times \pi \times 2^2 \\
 &= \frac{9}{2}\pi + \pi \\
 &= 17.27875959... \\
 &= \boxed{17.3 \text{ m}^2} \text{ (to 1dp)}
 \end{aligned}$$

- (d) Winkle took three measurements at 4-metre intervals across an irregular shaped dam on her farm, as shown on the diagram. She measured the depth of water at each of the intervals, and the measurements were 9 m at AB and 12 m at PQ.

Use Simpson's rule to estimate the capacity of water in the dam, to the nearest litre.

3



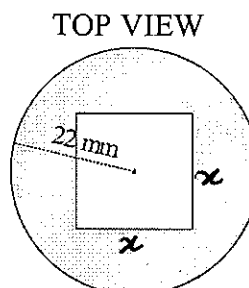
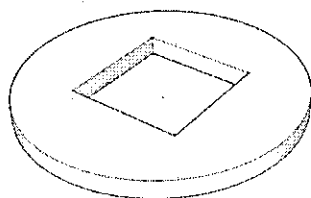
$$V = \frac{h}{3} [A_f + 4A_m + A_L]$$

$$= \frac{4}{3} [(3 \times 9) + 4(5 \times 12) + 0]$$

$$= 356 \text{ m}^3 \times 1000$$

$$\text{capacity} = \boxed{356,000 \text{ L}}$$

- (d) A new coin is being produced, featuring a circular design with a square hole cut out of it. The coin has a radius of 22 mm and a thickness of 3 mm.



To achieve the desired weight, the coin must have a volume of 4400 mm^3 .

Calculate the dimensions of the square that will result in this volume, in millimetres, correct to 3 significant figures.

3

let side of square = x

$$\therefore \text{Vol coin} = \pi r^2 H - (x \times x \times 3)$$

$$4400 = (\pi \times 22^2 \times 3) - 3x^2$$

$$4400 = 1452\pi - 3x^2$$

$$3x^2 = 4561.592533... - 4400$$

$$3x^2 = 161.592533$$

$$x^2 = 53.864177...$$

$$x = 7.3392218...$$

$$x = 7.34 \text{ mm}$$

$$\therefore \text{dimensions} = 7.34 \times 7.34 \text{ mm}$$

End of Paper