



Founded 1982

NUMBER: \_\_\_\_\_

TEACHER: \_\_\_\_\_

**THE HILLS GRAMMAR SCHOOL**

**YEAR 12**

**Trial HSC EXAMINATION 2015**

# **MATHEMATICS GENERAL**

**Time Allowed:** Two and a half hours (plus five minutes reading time)

**Teacher Responsible:** Mr O'Neill

## **Instructions**

- Attempt all questions.
- Answer all questions in Section I on the Multiple Choice Answer sheet provided at the back of the examination paper.
- Answer all questions in Section II in the spaces provided.
- Write using blue or black pen.
- Diagrams are not to scale.
- Marks may be deducted for careless, untidy or badly arranged work.

| Section I | Section II<br>Question 26 | Section II<br>Question 27 | Section II<br>Question 28 | Section II<br>Question 29 | Section II<br>Question 30 | TOTAL |
|-----------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|-------|
| 25        | 15                        | 15                        | 15                        | 15                        | 15                        | 100   |

**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** Simplify  $6x^2 + 2x + 4x^2$ 

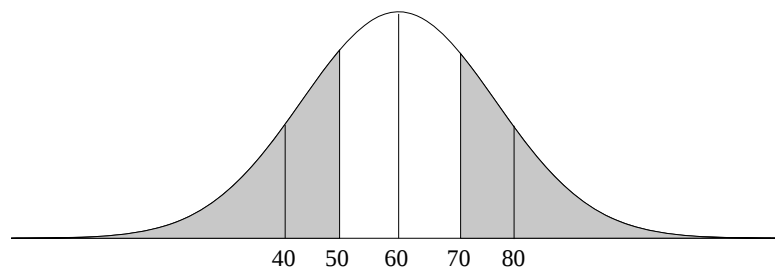
- (A)  $12x^2$
- (B)  $12x^4$
- (C)  $10x^2 + 2x$
- (D)  $10x^4 + 2x$

**2** Which of the following represents 0.5 MB to nearest 1000?

- (A) 430000 B
- (B) 524000 B
- (C) 530000 B
- (D) 525000 B

**3** Which of these functions represents exponential growth?

- (A)  $y = 2(5^x)$
- (B)  $y = 3(0.2)^x$
- (C)  $y = \frac{3}{x}$
- (D)  $y = 4x^3$

**4** The normal distribution shows the results of a mathematics assessment task. It has a mean of 60 and a standard deviation of 10

What percentage of results lies in the shaded region?

- (A) 16%
- (B) 32%
- (C) 34%
- (D) 68%

- 5 Use the table below to calculate the present value of an annuity where \$12,000 is contributed each year for six years into an account earning 3% per annum compound interest.

| Present value of \$1 |        |        |        |        |
|----------------------|--------|--------|--------|--------|
| End of year          | 3%     | 4%     | 5%     | 6%     |
| 5                    | 4.5797 | 4.4518 | 4.3295 | 4.2124 |
| 6                    | 5.4172 | 5.2421 | 5.0757 | 4.9173 |
| 7                    | 6.2303 | 6.0021 | 5.7864 | 5.5824 |
| 8                    | 7.0197 | 6.7327 | 6.4632 | 6.2098 |

- (A) \$15,183.83  
 (B) \$54,956.40  
 (C) \$65,006.40  
 (D) \$72,000.00
- 6 Zac is driving at a speed ( $V$ ) of 80 km/h. It takes Zac two seconds to react to a dangerous situation before applying the brakes. The stopping distance ( $d$ ) is given by the formula:

$$\text{Stopping distance: } d = \frac{5Vt}{18} + \frac{V^2}{170}$$

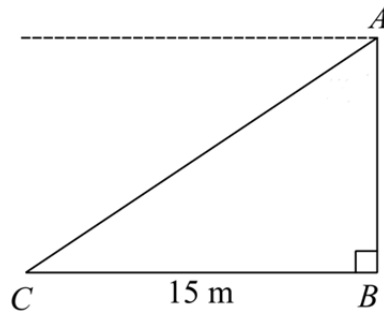
Where  $V$  = speed of vehicle

$t$  = reaction time in seconds

How far will Zac travel in his car after applying the brakes using this formula?

- (A) 60 m  
 (B) 82 m  
 (C) 164 m  
 (D) 246 m

- 7 The angle of depression from  $A$  to  $C$  is  $40^\circ$ . The distance from  $B$  to  $C$  is 15 metres.

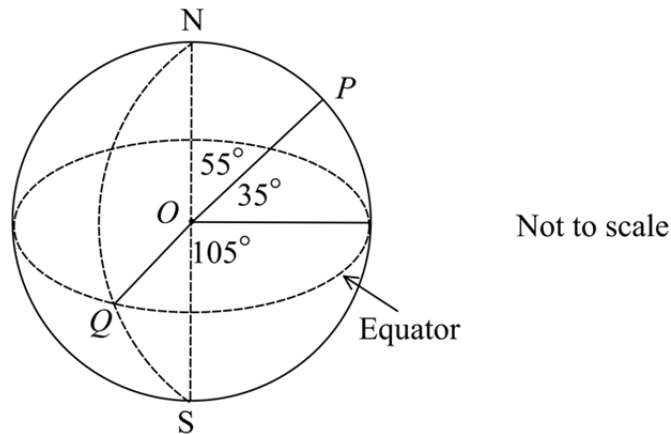


Not to scale

How high above  $B$  is  $A$ , to the nearest metre?

- (A) 10 m  
 (B) 11 m  
 (C) 13 m  
 (D) 18 m
- 8 Jasmine purchased a used car for \$7 500 and depreciated it by \$700 each year. What is its depreciated value after three years?
- (A) \$4 700  
 (B) \$5 400  
 (C) \$6 100  
 (D) \$6 800
- 9 Adelaide is located at  $(35^\circ\text{S}, 139^\circ\text{E})$  and Yokohama is located at  $(35^\circ\text{N}, 139^\circ\text{E})$ . What is the distance between Adelaide and Yokohama to the nearest kilometre? (Assume the radius of the earth is 6400 km).
- (A) 559  
 (B) 3910  
 (C) 7819  
 (D) 15 526
- 10 What is the gradient of the least-squares regression line given  $r = 0.561$ ,  $s_x = 1.987$  and  $s_y = 4.579$ ?
- (A) 0.24  
 (B) 1.29  
 (C) 7.13  
 (D) 16.21

- 11 In the diagram,  $O$  represents the centre of the earth, and  $Q$  lies on both the Equator and the Greenwich Meridian.



What is the latitude and longitude of point  $P$ ?

- (A)  $35^\circ\text{N } 105^\circ\text{E}$   
 (B)  $35^\circ\text{N } 105^\circ\text{W}$   
 (C)  $55^\circ\text{N } 105^\circ\text{E}$   
 (D)  $55^\circ\text{N } 105^\circ\text{W}$
- 12 A 120 watt ceiling fan is run for 24 hours each day. If electricity is charged at 24.8 c/kWh, what is the cost of running the ceiling fan for 30 days, to the nearest cent?
- (A) \$15.68  
 (B) \$21.43  
 (C) \$86.40  
 (D) \$2142.73
- 13 Lachlan earns \$81 500 in a year. His allowable deductions total \$4 000. Using the table below, which of the following expressions represents his total tax payable?

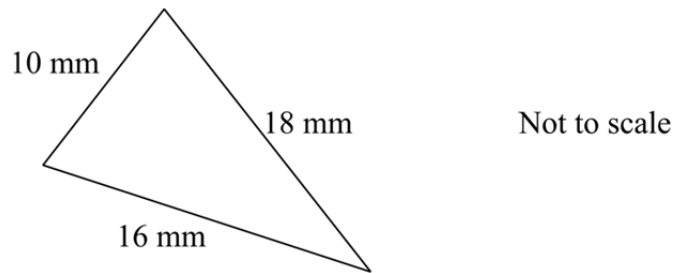
| <i>Taxable income</i> | <i>Tax payable</i>                              |
|-----------------------|-------------------------------------------------|
| 0 - \$18 200          | Nil                                             |
| \$18 201 - \$37 000   | Nil + 19 cents for each \$1 over \$18 200       |
| \$37 001 - \$80 000   | \$3572 + 32.5 cents for each \$1 over \$37 000  |
| \$80 001 - \$180 000  | \$17 550 + 37 cents for each \$1 over \$80 000  |
| \$180 001 and over    | \$54 550 + 45 cents for each \$1 over \$180 000 |

- (A)  $\$3572 + \$40\,500 \times 0.325$   
 (B)  $\$3572 + \$44\,500 \times 0.325$   
 (C)  $\$17\,550 + \$1\,500 \times 0.37$   
 (D)  $\$17\,550 + \$5\,500 \times 0.37$

14 What is the best description between living standards and life expectancy?

- (A) Constant correlation
- (B) Negative correlation.
- (C) Positive correlation.
- (D) Zero correlation.

15 What is the size of the smallest angle ( $\theta$ ) in the triangle below?



- (A)  $\cos \theta = \frac{16^2 + 18^2 - 10^2}{2 \times 10 \times 16}$
- (B)  $\cos \theta = \frac{10^2 + 18^2 - 16^2}{2 \times 10 \times 18}$
- (C)  $\cos \theta = \frac{10^2 + 18^2 - 16^2}{2 \times 10 \times 16}$
- (D)  $\cos \theta = \frac{16^2 + 18^2 - 10^2}{2 \times 16 \times 18}$

16 Oscar borrows \$800 over 3 years at an interest rate of 9.5% p.a. Calculate the simple interest?

- (A) \$29
- (B) \$86
- (C) \$228
- (D) \$343

17 A factory produces bags of cashews. The weights of the bags are normally distributed, with a mean of 900 g and a standard deviation of 50 g. What is the best approximation for the percentage of bags that weigh more than 1000 g?

- (A) 0%
- (B) 2.5%
- (C) 5%
- (D) 16%

- 18** The number of residents at Ashcroft is expected to increase using the formula  $N = 3000t^3$ , where  $N$  is the number of residents and  $t$  is the time in years. What is the expected number of residents of Ashcroft after three years?

(A) 9000  
(B) 27 000  
(C) 78 000  
(D) 81 000

- 19** Which of the following correctly expresses  $c$  as the subject of  $A = bc^2 + d$ ?

(A)  $c = \pm \sqrt{\frac{A-d}{b}}$

(B)  $c = \pm \frac{\sqrt{A-d}}{b}$

(C)  $c = \pm \sqrt{\frac{A}{b}} - d$

(D)  $c = \pm \sqrt{\frac{A}{b} - d}$

- 20** The speed ( $v$ ), in km/h, of a ski lift is inversely proportional to the weight ( $w$  kg) it carries. A ski lift carrying a weight of 320 kg can travel at 16 km/h. What is the speed of the ski lift if weight decreases to 250 kg?

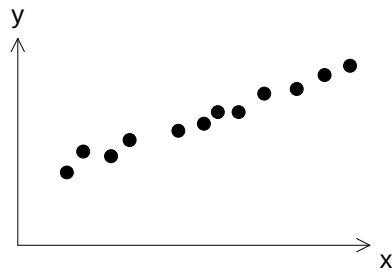
(A)  $\frac{16 \times 250}{320}$

(B)  $\frac{16 \times 320}{250}$

(C)  $\frac{250 \times 320}{16}$

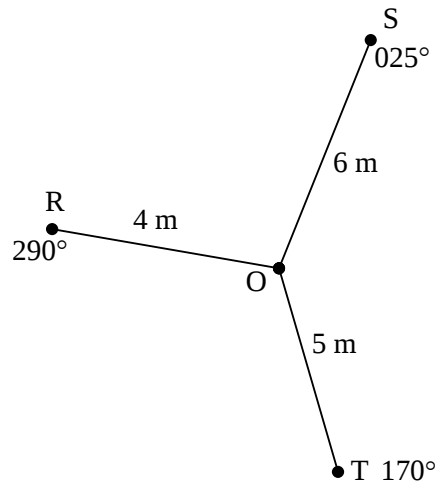
(D)  $\frac{320}{16 \times 250}$

21 What is the correlation between the variables in this scatterplot?



- (A) Low negative
- (B) Low positive
- (C) High negative
- (D) High positive

22 A radial survey is shown below.

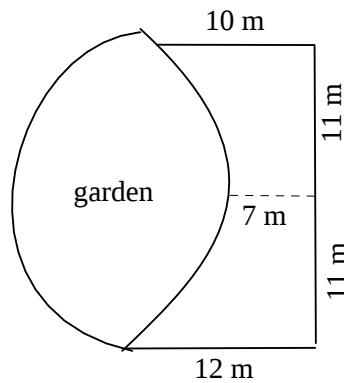


Find the area of the  $\triangle ROS$  correct to the nearest square metre.

- |                      |                      |
|----------------------|----------------------|
| (A) $5 \text{ m}^2$  | (B) $9 \text{ m}^2$  |
| (C) $11 \text{ m}^2$ | (D) $12 \text{ m}^2$ |

- 23 A field is bordered by three straight fences and a garden as shown below.

Not to Scale



What is the area of the field ( in square metres)?

- (A)  $\frac{11}{3}(12 + 7 + 10)$  (B)  $\frac{11}{3}(12 + 28 + 10)$   
 (C)  $\frac{22}{3}(12 + 7 + 10)$  (D)  $\frac{22}{3}(12 + 28 + 10)$
- 24 Sascha measured a piece of material for her HSC major work as 200 mm correct to the nearest millimetre. What is the percentage error in her measurement?
- (A)  $\pm 0.0025\%$  (B)  $\pm 0.005\%$  (C)  $\pm 0.25\%$  (D)  $\pm 0.5\%$
- 25 A car depreciates in value from \$39 000 to \$12 250 in four years using the declining balance method. What is the annual rate of depreciation to the nearest whole number?
- (A) 17% (B) 18% (C) 25% (D) 26%

## Section II

75 marks

Attempt Questions 26 – 30

Allow about 1 hour and 55 minutes for this section

Answer the questions in the spaces provided.

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

### Question 26 (15 marks)

**Marks**

- (a) Sophie borrowed \$192 000 at an interest rate of 5.25% per annum compounded monthly. The repayments have been set at \$900 per month.

| Months ( $n$ ) | Principal ( $P$ ) | Interest ( $I$ ) | Repayment | Balance |
|----------------|-------------------|------------------|-----------|---------|
| 1              | \$192 000         | \$840            | \$900     |         |
| 2              |                   |                  | \$900     |         |

- (i) Show by calculation that the interest charged for the first month is \$840. 1

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

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- (iii) What is the interest charged for the second month? Answer to the nearest cent. 2

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- (b) Simplify  $(6xy^2)^3$  2

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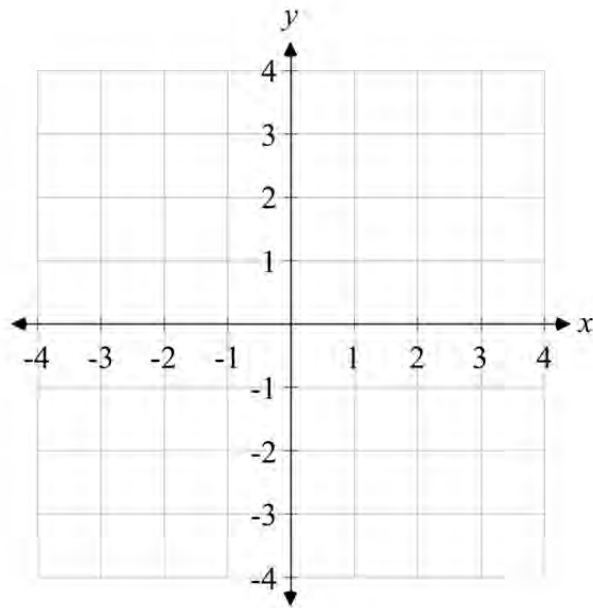
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- (c) Draw the graph of  $y = -2x + 3$  and find the gradient and  $y$ -intercept.

3



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- (d) An energy company charges for gas over a 3-month period are shown below.

|                     |                         |                  |
|---------------------|-------------------------|------------------|
| <b>Usage charge</b> | First 2000 MJ           | \$0.02580 per MJ |
|                     | Additional MJ over 2000 | \$0.01620 per MJ |

- (i) Savannah used 5000 MJ of gas in this period. What is the charge? 2

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- (ii) Gabriel has decided to reduce his energy bills. He has a target of \$80 for gas. What is the maximum number of MJ he is allowed in this period? Answer correct to the nearest megajoule. 2

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- (e) A credit card has a daily simple interest rate of 0.059% per day (no interest free period). Find the interest charged on \$2210 for 14 days. Answer correct to the nearest cent. 2

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**Question 27** (15 marks)

**Marks**

- (a) Alex is planning a trip to Toronto (44°N 79°W) from Sydney (34°S 151°E).

- (i) What is the difference in time between Toronto and Sydney to the nearest minute?

2

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- (ii) Alex plans to leave Sydney at 6 am on a Sunday. What is the time in Toronto when he leaves Sydney?

2

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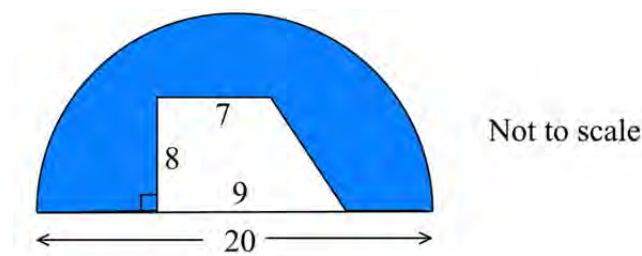
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- (b) The diagram shows a semicircle, from which a trapezium has been cut. All measurements are in centimetres.

3



What is the shaded area , to the nearest square centimetre?

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- (c) Clark's rule  $\left( \text{Dosage} = \frac{\text{Weight (kg)} \times \text{Adult dose}}{70} \right)$  is used to calculate dosages of medicine for children. What is the medication dose for Tyler, if he weighs 28 kg and the adult dose is 15 mL?

1

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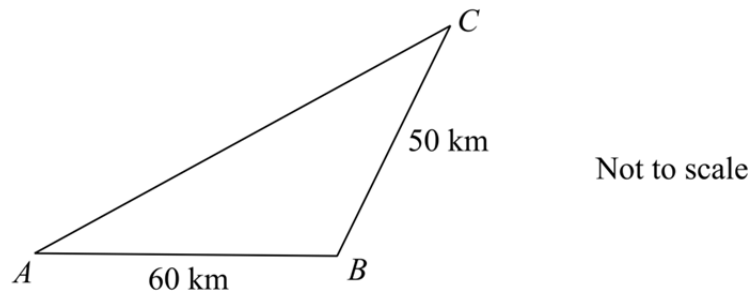


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- (d) The diagram shows three towns. Town  $A$  is due west of town  $B$  and the bearing of town  $C$  from town  $B$  is  $025^\circ$ .



- (i) What is the size of  $\angle ABC$ ? 2

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- (ii) Find the distance (to nearest kilometre) from town  $A$  to town  $C$ . 2

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- (iii) What is the bearing of town  $C$  from town  $A$ ? 3

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**Question 28** (15 marks)

**Marks**

(a) Solve the following equations:

(i)  $9x - 2 = -11$

**2**

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(ii)  $\frac{4y}{3} + 3y - 5 = 0$

**2**

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(b) A rain gauge registered 60 mm of rain during a storm. The rain fell on a shed with a rectangular roof that measures 25 metres by 10 metres.

(i) How many litres of water fell on the shed? Answer to the nearest litre

**2**

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(ii) The water that fell on the shed was collected in an empty cylindrical tank with a diameter of 6 metres. What depth of water will be in the tank? Answer correct to two decimal places.

**2**

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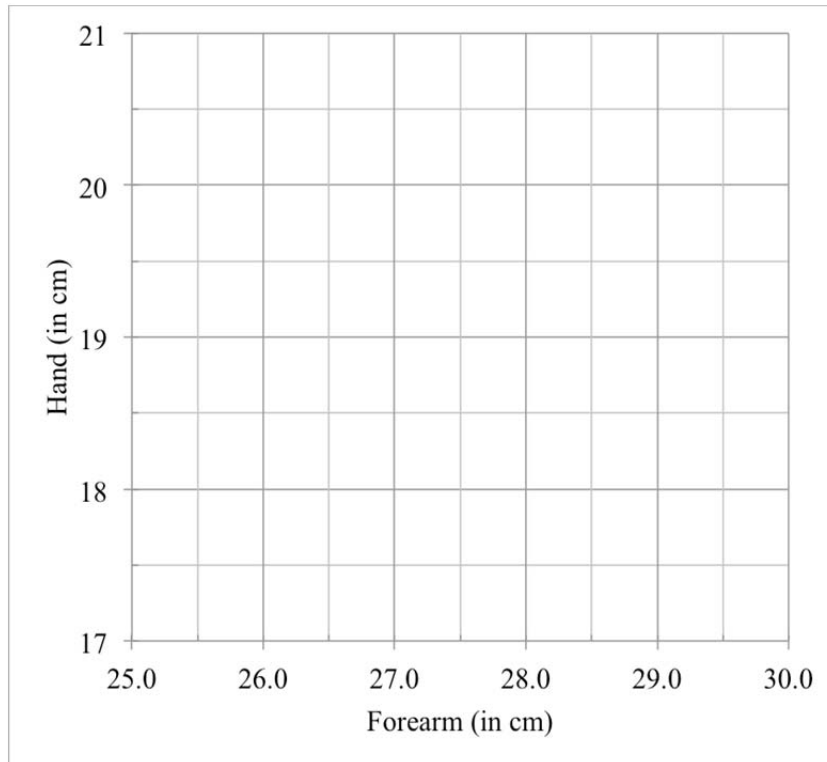
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- (c) The table below shows forearm length and hand length.

|                        |      |      |      |      |      |      |      |      |      |      |
|------------------------|------|------|------|------|------|------|------|------|------|------|
| <b>Forearm (in cm)</b> | 25.0 | 25.5 | 26.0 | 26.5 | 27.0 | 27.5 | 28.0 | 28.5 | 29.0 | 29.5 |
| <b>Hand (in cm)</b>    | 17.3 | 17.6 | 18.2 | 18.4 | 19   | 19.4 | 19.8 | 20.1 | 20.4 | 20.6 |

- (i) Draw a scatterplot using the above table.

1



- (ii) Draw a line of best fit on the scatterplot.

1

- (iii) Calculate the correlation coefficient between the forearm length and hand length.

1

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- (d) Emily borrows \$2700 to buy a dining table. Her repayments are \$135 a month for two years.

i) What interest does Emily pay?

2

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ii) What flat rate of interest per annum has Emily been charged?

2

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**Question 29** (15 marks)

**Marks**

- (a) Young's rule is used to prescribe medicine for children. The formula is:

$$\text{Young's rule: } D = \frac{yA}{y+12}$$

**Where D = child dosage**

**y=age in years**

**A= adult dosage**

Owen buys a prescription for 1200 mg of medicine. The adult dose is 50 mg and the recommended dose for Owen's child is 10 mg.

- (i) How old is Owen's child using Young's rule? **2**

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- (ii) How many doses for Owen's child are contained in the prescription? **1**

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- (iii) It is recommended the medicine be taken at most 4 times a day. How many days will the prescription last at this rate for Owen's child? **1**

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- (b) The capture-recapture technique was used to estimate the population of penguins in 2013. 2

- 50 penguins were caught, tagged and released.
- Later, 110 penguins were caught at random.
- 20 of these 110 penguins had been tagged.

The estimated population of the penguins in 2013 was 13% less than the estimated population for 2012.

What was the estimated population for 2012?

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- (c) Jack has a mobile phone contract that charges a monthly access fee of \$79, \$250 worth of calls are free, flag fall \$0.35 and call rate of \$0.45 per 30 second. What is the monthly charge if Jack made 400 calls whose duration was less than 30 seconds? 2

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- (d) Charlotte is 57 kg and has consumed 5 standard drinks in the past four hours. She was stopped by police for a random breath test.

What would be Charlotte's blood alcohol content? Answer correct to 2 decimal places. 1

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e) Solve the following pair of simultaneous equations.

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$$\begin{aligned} 2x - 3y &= -1 \\ x &= 10 - 2y \end{aligned}$$

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(f) Sally's recent results in hospitality and timber are recorded in the table

| Course      | Class Mean | Class Standard Deviation | Sally's Result |
|-------------|------------|--------------------------|----------------|
| Hospitality | 55         | 10                       | 85             |
| Timber      | 55         | 15                       | 85             |

(i) What is Sally's z-score for timber?

1

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(ii) What hospitality mark would be equivalent to a z-score of -1?

1

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(iii) What percentage of students in Sally's class scored a mark between 45 and 75 for Hospitality?

2

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**Question 30** (15 marks)

**Marks**

- (a) Michael invests \$3125 at 12% per annum compounding quarterly. How much will he have after 4 years? Answer to the nearest dollar.

**2**

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- (b) Using the compound interest formula, calculate the present value of an annuity whose future value is \$480,000 over 8 years with an interest rate of 8.2% per annum compounded monthly. Answer correct to the nearest cent.

**2**

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- (c) The table below shows the future value on \$1 compounding at the interest rate per period.

**2**

| Future value of \$1 |      |      |      |      |
|---------------------|------|------|------|------|
| End of period       | 4%   | 6%   | 8%   | 10%  |
| 1                   | 1.00 | 1.00 | 1.00 | 1.00 |
| 2                   | 2.04 | 2.06 | 2.08 | 2.10 |
| 3                   | 3.12 | 3.18 | 3.25 | 3.31 |
| 4                   | 4.25 | 4.37 | 4.51 | 4.64 |

Calculate the future value of a \$32 000 annuity for 2 years at 8% p.a. compounded half yearly.

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- (d) An asteroid reached earth and exploded in the Pacific Ocean. The distance (in km) it travelled through the earth's atmosphere varied directly as the square of the time ( $t$  sec) it had been travelling. The asteroid travelled 384 kilometres in the first 16 seconds.

i) How far did the asteroid travel in the first 10 seconds?

2

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ii) How long will it take for the asteroid to travel 294 kilometres?

2

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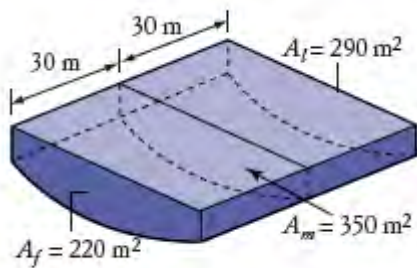


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- (e) Calculate the capacity of the following in Megalitres using Simpson's Rule for volume. 2




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- f) The angle of elevation from a boat out to sea to the top of a 220-metre cliff is  $37^\circ$ . After travelling directly towards the cliff the angle of elevation from the boat to the top of the cliff is  $56^\circ$ .

- i) Draw a diagram representing the information above

**1**

- ii) How far did the boat travel towards the cliff? Answer correct to the nearest metre. **2**

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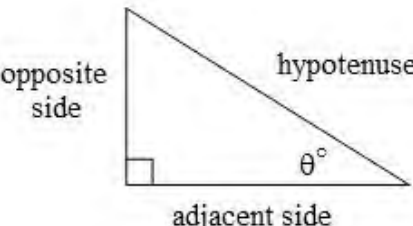
**End of paper**



## FORMULAE AND DATA SHEET

| Financial Mathematics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Data Analysis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
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| <p><b>Simple interest</b></p> $I = Prn$ <p> <math>P</math> is initial amount<br/> <math>r</math> is interest rate per period, expressed as a decimal<br/> <math>n</math> is number of periods </p> <p><b>Compound interest</b></p> $A = P(1 + r)^n$ <p> <math>A</math> is final amount<br/> <math>P</math> is initial amount<br/> <math>r</math> is interest rate per period, expressed as a decimal<br/> <math>n</math> is number of compounding periods </p> <p><b>Present value and future value</b></p> $PV = \frac{FV}{(1 + r)^n}, FV = PV(1 + r)^n$ <p> <math>r</math> is interest rate per period, as expressed as a decimal<br/> <math>n</math> is number of compounding periods </p> <p><b>Straight-line method of depreciation</b></p> $S = V_0 - Dn$ <p> <math>S</math> is salvage value of asset after <math>n</math> periods<br/> <math>V_0</math> is initial value of asset<br/> <math>D</math> is amount of depreciation per period<br/> <math>n</math> is number of periods </p> <p><b>Declining-balance method of depreciation</b></p> $S = V_0(1 - r)^n$ <p> <math>S</math> is salvage value of asset after <math>n</math> periods<br/> <math>V_0</math> is initial value of asset<br/> <math>r</math> is depreciation rate per period, expressed as a decimal<br/> <math>n</math> is number of periods </p> | <p><b>Mean of a sample</b></p> $\bar{x} = \frac{\text{sum of scores}}{\text{number of scores}}$ <p><b>z-score</b></p> <p>For any score <math>x</math>,</p> $z = \frac{x - \bar{x}}{s}$ <p> <math>\bar{x}</math> is mean<br/> <math>s</math> is standard deviation </p> <p><b>Outlier(s)</b></p> <p>score(s) less than <math>Q_L - 1.5 \times IQR</math> or<br/> score(s) more than <math>Q_U + 1.5 \times IQR</math></p> <p> <math>Q_L</math> is lower quartile<br/> <math>Q_U</math> is upper quartile<br/> <math>IQR</math> is interquartile range </p> <p><b>Least-squares line of best fit</b></p> $y = \text{gradient} \times x + y\text{-intercept}$ $\text{gradient} = r \times \frac{\text{standard deviation of } y \text{ scores}}{\text{standard deviation of } x \text{ scores}}$ $y\text{-intercept} = \bar{y} - (\text{gradient} \times \bar{x})$ <p> <math>r</math> is correlation coefficient<br/> <math>\bar{x}</math> is mean of <math>x</math> score<br/> <math>\bar{y}</math> is mean of <math>y</math> scores </p> <p><b>Normal distribution</b></p> <ul style="list-style-type: none"> <li>approximately 68% of scores have z-scores between <math>-1</math> and <math>1</math></li> <li>approximately 95% of scores have z-scores between <math>-2</math> and <math>2</math></li> <li>approximately 99.7% of scores have z-scores between <math>-3</math> and <math>3</math></li> </ul> |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p style="text-align: center;"><b>Spherical Geometry</b></p> <p><b>Circumference of a circle</b></p> $C = 2\pi r \text{ or } C = \pi d$ <p><math>r</math> is radius<br/> <math>d</math> is diameter</p> <p><b>Arc length of a circle</b></p> $l = \frac{\theta}{360} 2\pi r$ <p><math>r</math> is radius<br/> <math>\theta</math> is number of degrees in central angle</p> <p><b>Radius of Earth</b><br/>         (taken as) 6400 km</p> <p><b>Time differences</b><br/>         For calculation of time differences using longitude: <math>15^\circ = 1</math> hour time difference</p>                                                                                                                                | <p style="text-align: center;"><b>Surface Area</b></p> <p><b>Sphere</b></p> $A = 4\pi r^2$ <p><math>r</math> is radius</p> <p><b>Closed cylinder</b></p> $A = 2\pi r^2 + 2\pi rh$ <p><math>r</math> is radius<br/> <math>h</math> is perpendicular height</p>                                                                                                                                                                                                                                                                                                                                        |
| <p style="text-align: center;"><b>Area</b></p> <p><b>Circle</b></p> $A = \pi r^2$ <p><math>r</math> is radius</p> <p><b>Sector</b></p> $A = \frac{\theta}{360} \pi r^2$ <p><math>r</math> is radius<br/> <math>\theta</math> is number of degrees in central angle</p> <p><b>Annulus</b></p> $A = \pi(R^2 - r^2)$ <p><math>R</math> is radius of outer circle<br/> <math>r</math> is radius of inner circle</p> <p><b>Trapezium</b></p> $A = \frac{h}{2}(a + b)$ <p><math>h</math> is perpendicular height<br/> <math>a</math> and <math>b</math> are the lengths of the parallel sides</p> <p><b>Area of land and catchment areas</b><br/>         unit conversion: <math>1 \text{ ha} = 10\,000 \text{ m}^2</math></p> | <p style="text-align: center;"><b>Volume</b></p> <p><b>Prism or cylinder</b></p> $V = Ah$ <p><math>r</math> is radius<br/> <math>h</math> is perpendicular height</p> <p><b>Pyramid or cone</b></p> $V = \frac{1}{3} Ah$ <p><math>A</math> is area of the base<br/> <math>h</math> is perpendicular height</p> <p><b>Volume and capacity</b><br/>         unit conversion: <math>1 \text{ m}^3 = 1000 \text{ L}</math></p>                                                                                                                                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p style="text-align: center;"><b>Approximation Using Simpson's Rule</b></p> <p><b>Area</b></p> $A \approx \frac{h}{3}(d_f + 4d_m + d_l)$ <p><math>h</math> distance between successive measurements<br/> <math>d_f</math> is first measurement<br/> <math>d_m</math> is middle measurement<br/> <math>d_l</math> is last measurement</p> <p><b>Volume</b></p> $V \approx \frac{h}{3}(A_L + 4A_m + A_R)$ <p><math>h</math> distance between successive measurements<br/> <math>A_L</math> is area of left end<br/> <math>A_m</math> is area of middle<br/> <math>A_R</math> is area of right end</p> |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Trigonometric Ratios</b></p>  <p> <math>\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}</math><br/> <math>\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}</math><br/> <math>\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}</math> </p> <p><b>Sine rule</b><br/>In <math>\triangle ABC</math></p> $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ <p><b>Area of Triangle</b></p> $A = \frac{1}{2}ab\sin C$ <p><b>Cosine rule</b><br/>In <math>\triangle ABC</math></p> $c^2 = a^2 + b^2 - 2ab\cos C$ <p>or</p> $\cos C = \frac{a^2 + b^2 - c^2}{2ab}$ | <p><b>Blood Alcohol Content Estimates</b></p> $BAC_{\text{Male}} = \frac{(10N - 7.5H)}{6.8M} \text{ or}$ $BAC_{\text{Female}} = \frac{(10N - 7.5H)}{5.5M}$ <p> <math>N</math> is number of standard drinks consumed<br/> <math>H</math> is number of hours of drinking<br/> <math>M</math> is person's mass in kilograms         </p> <hr/> <p><b>Distance, Speed and Time</b></p> $D = ST, S = \frac{D}{T}, T = \frac{D}{S}$ <p>average speed = <math>\frac{\text{total distance travelled}}{\text{total time taken}}</math></p> <p>stopping distance = <math>\left\{ \begin{array}{c} \text{reaction-time} \\ \text{distance} \end{array} \right\} + \left\{ \begin{array}{c} \text{braking} \\ \text{distance} \end{array} \right\}</math></p> <hr/> <p><b>Probability of an Event</b></p> <p>The probability of an event where outcomes are equally likely is given by:</p> $P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$ |
| <p><b>Units of Memory and File Size</b></p> <p>1 byte = 8 bits</p> <p>1 kilobyte = <math>2^{10}</math> bytes = 1024 bytes</p> <p>1 megabyte = <math>2^{20}</math> bytes = 1024 kilobytes</p> <p>1 gigabyte = <math>2^{30}</math> bytes = 1024 megabytes</p> <p>1 terabyte = <math>2^{40}</math> bytes = 1024 gigabytes</p>                                                                                                                                                                                                                                                                                                                                                                      | <p><b>Straight Lines</b></p> <p><b>Gradient</b></p> $m = \frac{\text{vertical change in position}}{\text{horizontal change in position}}$ <p><b>Gradient–intercept form</b></p> $y = mx + b$ <p> <math>m</math> is gradient<br/> <math>b</math> is y-intercept         </p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## MATHEMATICS: MULTIPLE CHOICE ANSWER SHEET

Student: \_\_\_\_\_

Teacher: \_\_\_\_\_

Select the alternative A, B, C or D that best answers the question. Fill in the response circle completely.

Sample:  $2 + 4 =$       A. 2    B. 6    C. 8    D. 9

|                         |                                  |                         |                         |
|-------------------------|----------------------------------|-------------------------|-------------------------|
| <input type="radio"/> A | <input checked="" type="radio"/> | <input type="radio"/> C | <input type="radio"/> D |
|-------------------------|----------------------------------|-------------------------|-------------------------|

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

|                         |                                  |                         |                                    |
|-------------------------|----------------------------------|-------------------------|------------------------------------|
| <input type="radio"/> A | <input checked="" type="radio"/> | <input type="radio"/> C | <input checked="" type="radio"/> 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 towards the correct answer.

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

|    |                         |                         |                         |                         |
|----|-------------------------|-------------------------|-------------------------|-------------------------|
| 16 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 17 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 18 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 19 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 20 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 21 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 22 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 23 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 24 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 25 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |

**MATHEMATICS: MULTIPLE CHOICE ANSWER SHEET**

Student: \_\_\_\_\_

Teacher: \_\_\_\_\_

Select the alternative A, B, C or D that best answers the question. Fill in the response circle completely.

Sample:  $2 + 4 =$       A. 2    B. 6    C. 8    D. 9

|                         |                                    |                         |                         |
|-------------------------|------------------------------------|-------------------------|-------------------------|
| <input type="radio"/> A | <input checked="" type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
|-------------------------|------------------------------------|-------------------------|-------------------------|

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

|                         |                                    |                         |                                    |
|-------------------------|------------------------------------|-------------------------|------------------------------------|
| <input type="radio"/> A | <input checked="" type="radio"/> B | <input type="radio"/> C | <input checked="" type="radio"/> 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 towards the correct answer.

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

|    |                                    |                                    |                                    |                                    |
|----|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| 16 | <input type="radio"/> A            | <input type="radio"/> B            | <input checked="" type="radio"/> C | <input type="radio"/> D            |
| 17 | <input type="radio"/> A            | <input checked="" type="radio"/> B | <input type="radio"/> C            | <input type="radio"/> D            |
| 18 | <input type="radio"/> A            | <input type="radio"/> B            | <input type="radio"/> C            | <input checked="" type="radio"/> D |
| 19 | <input checked="" type="radio"/> A | <input type="radio"/> B            | <input type="radio"/> C            | <input type="radio"/> D            |
| 20 | <input type="radio"/> A            | <input checked="" type="radio"/> B | <input type="radio"/> C            | <input type="radio"/> D            |
| 21 | <input type="radio"/> A            | <input type="radio"/> B            | <input type="radio"/> C            | <input checked="" type="radio"/> D |
| 22 | <input type="radio"/> A            | <input type="radio"/> B            | <input type="radio"/> C            | <input checked="" type="radio"/> D |
| 23 | <input type="radio"/> A            | <input checked="" type="radio"/> B | <input type="radio"/> C            | <input type="radio"/> D            |
| 24 | <input type="radio"/> A            | <input type="radio"/> B            | <input checked="" type="radio"/> C | <input type="radio"/> D            |
| 25 | <input type="radio"/> A            | <input type="radio"/> B            | <input checked="" type="radio"/> C | <input type="radio"/> D            |

*Most poorly attempted were*

*3, 11, 12, 14, 20, 22, 24, 25.*

## Section II

75 marks

Attempt Questions 26 – 30

Allow about 1 hour and 55 minutes for this section

Answer the questions in the spaces provided.

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

## Question 26 (15 marks)

Marks

- (a) Sophie borrowed \$192 000 at an interest rate of 5.25% per annum compounded monthly. The repayments have been set at \$900 per month.

| Months (n) | Principal (P) | Interest (I) | Repayment | Balance |
|------------|---------------|--------------|-----------|---------|
| 1          | \$192 000     | \$840        | \$900     | 191940  |
| 2          | 191940        | \$839.74     | \$900     |         |

- (i) Show by calculation that the interest charged for the first month is \$840.

1

$$I = \frac{192000 \times 5.25\%}{12} = \$840$$

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

1

$$192000 + 840 - 900 = 191940$$

\* Most incorrect was + 900

- (iii) What is the interest charged for the second month? Answer to the nearest cent.

2

$$\$839.74$$

\* MCF was used in this part

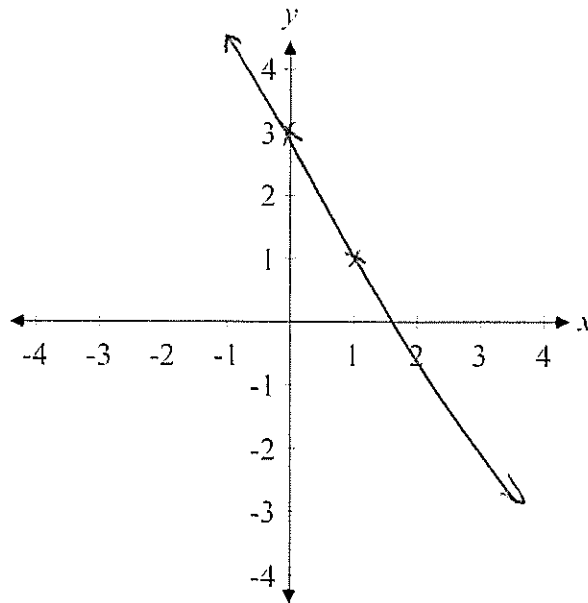
- (b) Simplify  $(6xy^2)^3$ .

$$216 x^3 y^6$$

\* Most incorrect response was with the powers eg  $xy^6$  or  $x^3y^5$

(c) Draw the graph of  $y = -2x + 3$  and find the gradient and y-intercept.

3



---


$$m = -2$$

---


$$b = 3$$


---

- \* Some students did not state y-intercept or gradient
- \* Most incorrect gradient was  $b = -1.5$ .
- \* Generally not well attempted.

- e) An energy company charges for gas over a 3-month period are shown below.

|              |                         |                  |
|--------------|-------------------------|------------------|
| Usage charge | First 2000 MJ           | \$0.02580 per MJ |
|              | Additional MJ over 2000 | \$0.01620 per MJ |

- (i) Savannah used 5000 MJ of gas in this period. What is the charge?

2

$$\begin{aligned}
 & 2000 \times 0.02580 \\
 & + 3000 \times 0.01620 \\
 & = \$100.20
 \end{aligned}$$

✓✓  
\* We'll Done!

- (ii) Gabriel has decided to reduce his energy bills. He has a target of \$80 for gas. What is the maximum number of MJ he is allowed in this period? Answer correct to the nearest megajoule.

2

$$\begin{aligned}
 & \text{First 2000} = 2000 \times 0.02580 \\
 & = \$51.60 \\
 & \therefore 80 - 51.60 = 28.40 \\
 & 28.40 \div 0.01620 = 1753 \\
 & \therefore 2000 + 1753 \\
 & = 3753 \text{ MJ}
 \end{aligned}$$

\* Most incorrect  
was 1753 kJ  
forget to  
add 2000

- (f) A credit card has a daily simple interest rate of 0.059% per day (no interest free period). Find the interest charged on \$2210 for 14 days. Answer correct to the nearest cent.

2

$$\begin{aligned}
 I &= 2210 \times 0.059\% \times 14 \\
 I &= \$18.25^d
 \end{aligned}$$

✓✓ Well Done

## Question 27 (15 marks)

Marks

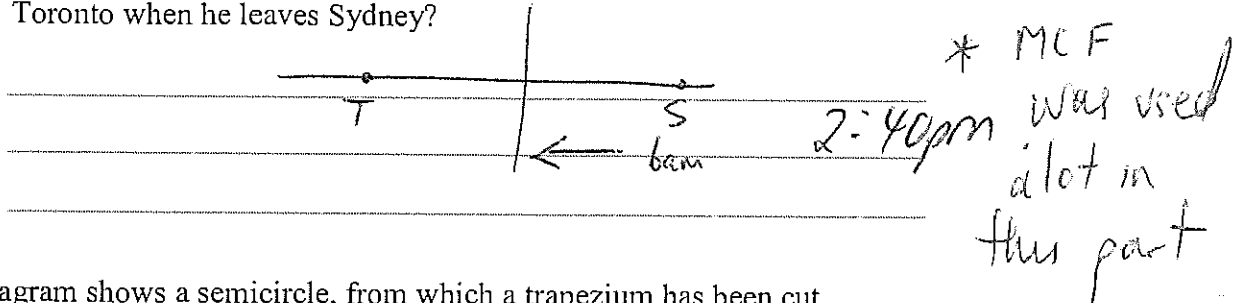
- (a) Alex is planning a trip to Toronto (
- $44^{\circ}\text{N } 79^{\circ}\text{W}$
- ) from Sydney (
- $34^{\circ}\text{S } 151^{\circ}\text{E}$
- ).

- (i) What is the difference in time between Toronto and Sydney to the nearest minute?

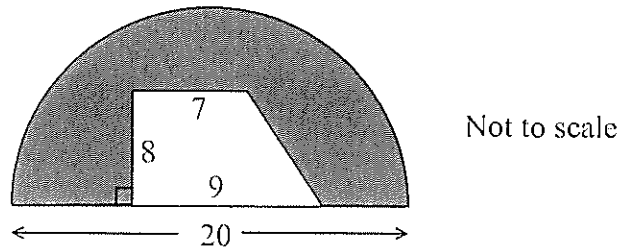
Time =  $79 + 151 = 230$  Most incorrect was 'minus'

$\therefore 230 \times 4 = 920 \div 60 = 15 \text{ hr } 20 \text{ min}$

- (ii) Alex plans to leave Sydney at 6 am on a Sunday. What is the time in Toronto when he leaves Sydney?



- (b) The diagram shows a semicircle, from which a trapezium has been cut. All measurements are in centimetres.



What is the shaded area, to the nearest square centimetre?

$$A = \pi \times 10^2 - \frac{1}{2} \times 8(7+9)$$

A number of  $\rightarrow (2)$

$= 157 - 64 = 93 \text{ m}^2$

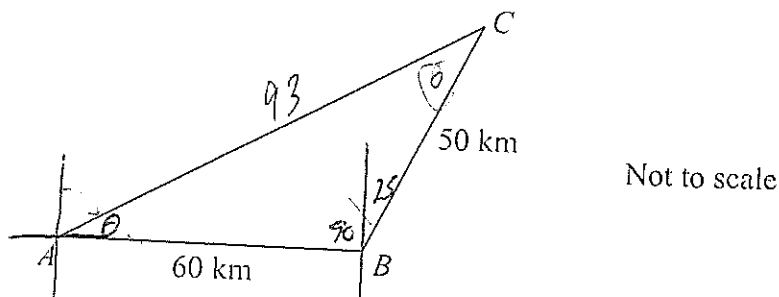
$\div \text{ divide by } 2$

- (c) Clark's rule (
- $\text{Dosage} = \frac{\text{Weight (kg)} \times \text{Adult dose}}{70}$
- ) is used to calculate dosages of medicine for children. What is the medication dose for Tyler, if he weighs 28 kg and the adult dose is 15 mL?

$$D = \frac{28 \times 15}{70} = 6 \text{ mL}$$

Well Done!

- (d) The diagram shows three towns. Town A is due west of town B and the bearing of town C from town B is  $025^\circ$ .



- (i) What is the size of  $\angle ABC$ ?

$$\therefore 90 + 25 = 115^\circ$$

\* Student found difficult

- (ii) Find the distance (to nearest kilometre) from town A to town C.

\* 1 mark was given

$$d^2 = 50^2 + 60^2 - 2 \times 50 \times 60 \times \cos 115^\circ \text{ for } 115^\circ$$

$$d^2 = 8635 - 7095$$

$$d = 93 \text{ km. MCF was used}$$

- (iii) What is the bearing of town C from town A?

3

$$\frac{\sin \theta}{60} = \frac{\sin 115}{93}$$

$$\sin \theta = \frac{\sin 115 \times 60}{93}$$

$$\theta = 36^\circ$$

$$\angle CAB = 180 - 36 - 115$$

$$\angle CAB = 29^\circ$$

$$\therefore \text{Bearing} = 90 - 29 = 061^\circ$$

\* Very few attempted or got this correct.

Remember the zero

## Question 28 (15 marks)

Marks

(a) Solve the following equations:

(i)  $9x - 2 = -11$   
 $\quad \quad \quad \downarrow 2 \quad +2$

2

$$9x = -9$$

several students subtract

$$x = -1$$

two

(ii)  $\frac{4y}{3} + 3y - 5 = 0$   
 $\quad \quad \quad \times 3 \quad \times 3 \quad \times 3 \quad \times 3$

2

$$4y + 9y - 15 = 0$$

\* student found

removing  $\frac{1}{3}$ from  $4y$  difficult

$$13y = 15$$

$$y = \frac{15}{13}$$

(b) A rain gauge registered 60 mm of rain during a storm. The rain fell on a shed with a rectangular roof that measures 25 metres by 10 metres.

(i) How many litres of water fell on the shed? Answer to the nearest litre

2

$$V = 25 \times 10 \times 0.06$$

recognise 60mm

$$= 15 \text{ m}^3$$

 $= 6 \text{ cm}$ 

$$= 15000 \text{ L}$$

 $= 0.06$ recognise  $1 \text{ m}^3 = 1000 \text{ L}$ 

(ii) The water that fell on the shed was collected in an empty cylindrical tank with a diameter of 6 metres. What depth of water will be in the tank? Answer correct to two decimal places.

2

$$15 = \pi \times 3^2 \times h$$

$$h = 0.53 \text{ m}$$

\* using the incorrect formula

$$V = \pi r^2 h \quad \text{ecf (i)}$$

$$V = 15 \text{ m}^3$$

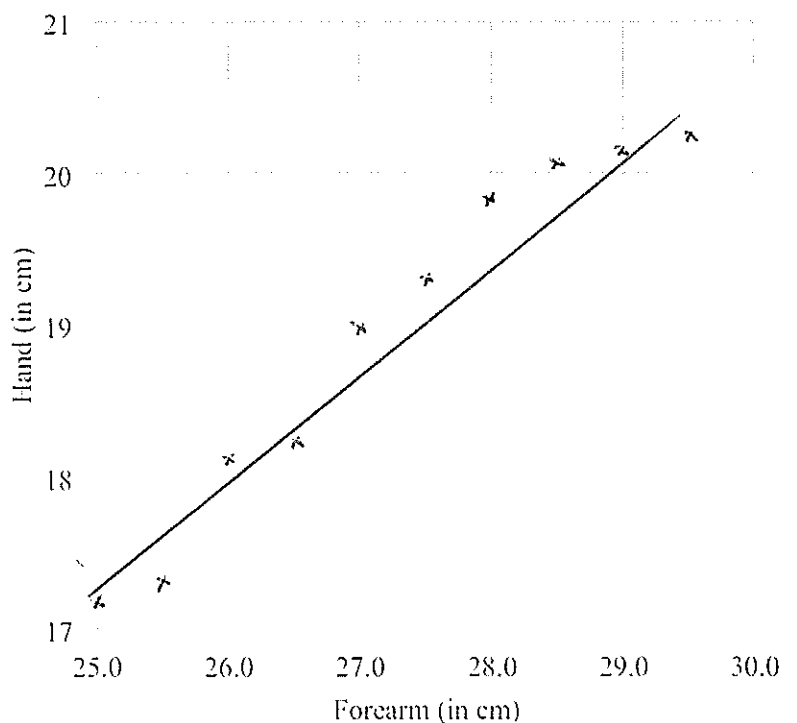
- (c) The table below shows forearm length and hand length.

| Forearm (in cm) | 25.0 | 25.5 | 26.0 | 26.5 | 27.0 | 27.5 | 28.0 | 28.5 | 29.0 | 29.5 |
|-----------------|------|------|------|------|------|------|------|------|------|------|
| Hand (in cm)    | 17.3 | 17.6 | 18.2 | 18.4 | 19   | 19.4 | 19.8 | 20.1 | 20.4 | 20.6 |

- (i) Draw a scatterplot using the above table.

1

Well Done.



- (ii) Draw a line of best fit on the scatterplot.

1

Must be a line.

- (iii) Calculate the correlation coefficient between the forearm length and hand length.

1

$$r = 0.99$$

$$r = 0.99$$

use calculator function  
in STAT mode to  
find  $r$

- (d) Emily borrows \$2700 to buy a dining table. Her repayments are \$135 a month for two years.

i) What interest does Emily pay?

2

$$R = 135 \times 12 \times 2$$

$$R = \$3240$$

$$\therefore I = 3240 - 2700$$

$$= \$540$$

some students found the total only.

ii) What flat rate of interest per annum has Emily been charged?

2

$$540 = \boxed{2700} \times r \times 2$$

$$540 \times r$$

$$\frac{5400}{5400}$$

$$0.1 = r$$

$$r = 10\% \text{ p.a.}$$

some students used \$3240 here.

## Question 29 (15 marks)

Marks

- (a) Young's rule is used to prescribe medicine for children. The formula is:

$$\text{Young's rule: } D = \frac{yA}{y+12}$$

Where  $D$  = child dosage $y$  = age in years $A$  = adult dosage

Owen buys a prescription for 1200 mg of medicine. The adult dose is 50 mg and the recommended dose for Owen's child is 10 mg.

- (i) How old is Owen's child using Young's rule?

2

$$10 = \frac{50}{y+12}$$

Mark for substitution.

$$10y + 120 = 50y$$

$$120 = 40y$$

$$y = 3 \text{ years old.}$$

common error  
 $10 \times 12 = 120$  (ii)

- How many doses for Owen's child are contained in the prescription?

1

120 doses.

Well Done

- (iii) It is recommended the medicine be taken at most 4 times a day. How many days will the prescription last at this rate for Owen's child?

1

$$120 \div 4 = 30 \text{ days}$$

Well Done

- (b) The capture-recapture technique was used to estimate the population of penguins in 2013. 2

- 50 penguins were caught, tagged and released.
- Later, 110 penguins were caught at random.
- 20 of these 110 penguins had been tagged.

The estimated population of the penguins in 2013 was 13% less than the estimated population for 2012.

What was the estimated population for 2012?

Calculation 2013 pop was well done.

$$P = \frac{50 \times 110}{20} = 275$$

Finding 2012 Population was completed poorly.  
 $P(2012) = 275 \div 0.87 = 316$

$$275 \div 87\% = 316$$

- (c) Jack has a mobile phone contract that charges a monthly access fee of \$79, \$250 worth of calls are free, flagfall \$0.35 and call rate of \$0.45 per 30 second. What is the monthly charge if Jack made 400 calls whose duration was less than 30 seconds? 2

$$\begin{aligned} \text{Cost} &= 400 \times (0.35 + 0.45) \\ &= 320 - 270 \\ &= \$70 \end{aligned}$$

There is a flagcall & a call rate for each of the 400 calls.

- (d) Charlotte is 57 kg and has consumed 5 standard drinks in the past four hours. She was stopped by police for a random breath test.

What would be Charlotte's blood alcohol content? Answer correct to 2 decimal places.

$$BAC = \frac{10 \times 5 - 7.5 \times 4}{5.5 \times 57}$$

$$BAC = 0.06$$

Well Done.

e) Solve the following pair of simultaneous equations.

2

$$\begin{aligned} 2x - 3y &= -1 \\ x &= 10 - 2y \end{aligned}$$

Well Done.

$$2(10 - 2y) - 3y = -1$$

$$20 - 4y - 3y = -1$$

$$-7y = -21$$

$$y = 3$$

$$x = 10 - 6 = 4$$

(f) Sally's recent results in hospitality and timber are recorded in the table

| Course      | Class Mean | Class Standard Deviation | Sally's Result |
|-------------|------------|--------------------------|----------------|
| Hospitality | 55         | 10                       | 85             |
| Timber      | 55         | 15                       | 85             |

Use formula

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

(i) What is Sally's z-score for timber?

1

$$z = \frac{85 - 55}{15} = +2$$

Well Done.

(ii) What hospitality mark would be equivalent to a z-score of -1?

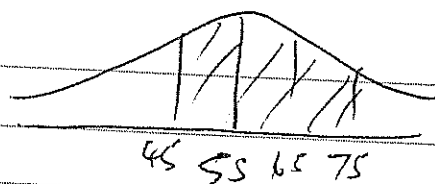
1

$$-1 = \frac{x - 55}{10} \quad x = 45$$

Well Done.

(iii) What percentage of students in Sally's class scored a mark between 45 and 75 for Hospitality?

2



$$= 81.5\%$$

Well Done.

## Question 30 (15 marks)

Marks

- a) Michael invests \$3125 at 12% per annum compounding quarterly. How much will he have after 4 years? Answer to the nearest dollar.

2

$$FV = 3125 \left(1 + \frac{3}{100}\right)^{16}$$

$$= \$5014.71$$

convert to quarters.

$$r = 12\% \div 4 = 3\%$$

$$n = 4 \times 4 = 16$$

- b) Using the compound interest formula, calculate the present value of an annuity whose future value is \$480,000 over 8 years with an interest rate of 8.2% per annum compounded monthly. Answer correct to the nearest cent.

2

$$FV = PV \left(1 + \frac{r}{100}\right)^n$$

convert to months

$$480000 = PV \left(1 + 0.683\%\right)^{96}$$

$$r = 8.2 \div 12$$

$$r = 0.683\%$$

$$n = 8 \times 12 = 96$$

$$PV = \frac{480000}{\left(1 + 0.683\%\right)^{96}} = \$249718.71$$

- (c) The table below shows the future value on \$1 compounding at the interest rate per period.

2

| Future value of \$1 |      |      |      |      |
|---------------------|------|------|------|------|
| End of period       | 4%   | 6%   | 8%   | 10%  |
| 1                   | 1.00 | 1.00 | 1.00 | 1.00 |
| 2                   | 2.04 | 2.06 | 2.08 | 2.10 |
| 3                   | 3.12 | 3.18 | 3.25 | 3.31 |
| 4                   | 4.25 | 4.37 | 4.51 | 4.64 |

convert to half yearly

$$r = 8\% \div 2$$

$$= 4\%$$

$$n = 2 \times 2 = 4$$

used 4.25.

Calculate the future value of a \$32 000 annuity for 2 years at 8% p.a. compounded half yearly.

$$32000 \times 4.25 = \$136000$$

- d) An asteroid reached earth and exploded in the Pacific Ocean. The distance (in km) it travelled through the earth's atmosphere varied directly as the square of the time ( $t$  sec) it had been travelling. The asteroid travelled 384 kilometres in the first 16 seconds.

Recognise Variation

- i) How far did the asteroid travel in the first 10 seconds?

2

$$d = kt^2 \quad d = 1.5t^2$$

$$384 = k \times 16^2$$

$$k = 1.5 \quad d = 1.5 \times 10^2$$

$$d = 150 \text{ km}$$

some students used  $\text{Speed} = \frac{\text{Distance}}{\text{Time}}$

- ii) How long will it take for the asteroid to travel 294 kilometres?

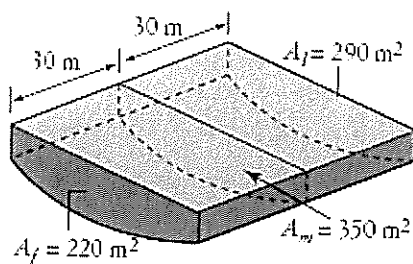
2

$$294 = 1.5d^2$$

$$196 = d^2$$

$$d = 14 \text{ sec}$$

- e) Calculate the capacity of the following in Megalitres using Simpson's Rule for volume. 2



$$V = \frac{30}{3} [220 + 4 \times 350 + 290]$$

$$= 19100 \text{ m}^3 = 19100000 \text{ L}$$

$$= 19100 \text{ KL}$$

$$= 19.1 \text{ ML}$$

Most achieved 19100KL

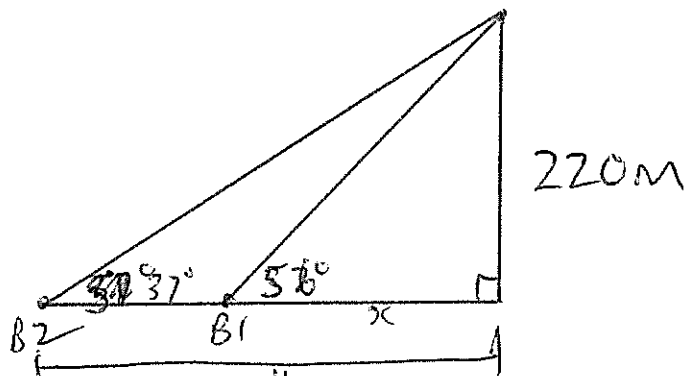
however found converting to ML

a challenge.

- f) The angle of elevation from a boat out to sea to the top of a 220-metre cliff is  $37^\circ$ . After travelling directly towards the cliff the angle of elevation from the boat to the top of the cliff is  $56^\circ$ .

i) Draw a diagram representing the information above

1



Well Drawn

- ii) How far did the boat travel towards the cliff? Answer correct to the nearest metre. 2

$$\tan 56 = \frac{220}{x}$$

$$\tan 37 = \frac{220}{y}$$

$$x = \frac{220}{\tan 56} = 148.39$$

$$y = \frac{220}{\tan 37}$$

$$y = 291.94$$

$$w = 291.94 - 148.39$$

$$= 143.55$$

$$w = 144 \text{ m}$$

Poorly done.

End of paper