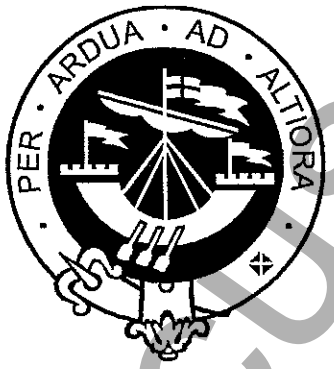
2009
SEMESTER ONE EXAMINATION

General Mathematics



General Instructions

- Reading time – 5 minutes
- Working time – $2\frac{1}{2}$ hours
- Write using blue or black pen
- Calculators may be used
- A formulae sheet is provided at the back of this paper

Total Marks – 100

Section I:
22 marks

- Attempt questions 1-22
- Allow about 30 minutes for this section

Section 2:
78 marks

- Attempt questions 23-28
- Allow about 2 hours for this section

SECTION 1

22 marks
Attempt Questions 1 to 22.
Allow about 30 minutes for this section.

Use the multiple-choice answer sheet for Questions 1-22.

1. What is the median of the set of scores?

3, 5, 1, 9, 8, 1

(A) 3 **(B)** 4 **(C)** 5 **(D)** 1

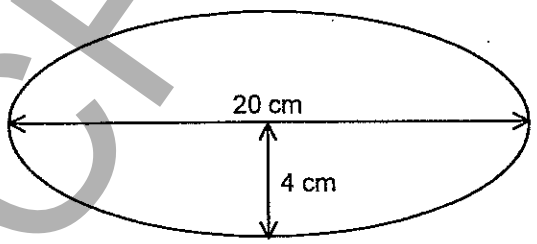
2. Daniel states that her essay has 4000 words correct to the nearest 100 words. What is the percentage error?

(A) $\pm 1\frac{2}{3}\%$ **(B)** $\pm 1.25\%$ **(C)** $\pm 2.5\%$ **(D)** $\pm 0.25\%$

3. James walks 5 metres due north then 12 metres due east. What is ~~her~~ his bearing from ~~her~~ his starting point?

(A) 067° **(B)** 023° **(C)** 247° **(D)** 293°

4. The area of this ellipse is given by

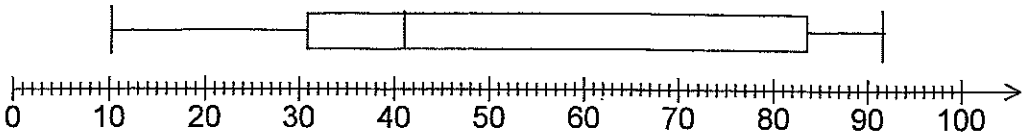


(A) $20 \times 4 \times \pi$ **(B)** $20 \times 8 \times \pi$ **(C)** $10 \times 4 \times \pi$ **(D)** $10 \times 8 \times \pi$

5. Josh has beaten Nathan at badminton in 15 out of the last 25 matches. The probability that Nathan will win the next match is:

(A) 0 **(B)** $\frac{3}{5}$ **(C)** $\frac{2}{5}$ **(D)** $\frac{1}{4}$

6. The box and whisker plot shows the results of a test for 200 students. How many students scored between 10 and 30?



(A) 20 **(B)** 50 **(C)** 25 **(D)** cannot tell

7. Claudia has four skirts and three jackets. In how many different ways can she choose an outfit which includes a skirt and jacket?

(A) 7 **(B)** 12 **(C)** 19 **(D)** 49

8. The student population at a women's college is shown

Year	No. of Students
1	56
2	32
3	21
4	11
Total	120

The college wishes to change some rules and plans a stratified survey of 50 students to find out the student reaction to the proposed changes. How many second year students should be included in the survey?

(A) 13 **(B)** 50 **(C)** 14 **(D)** 32

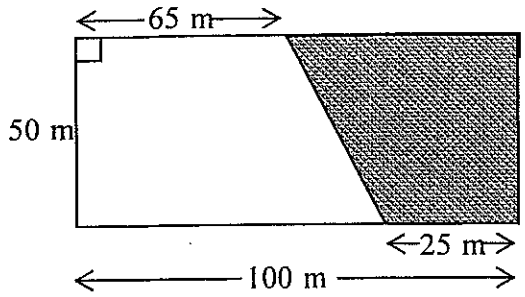
9. If the probability that it will rain tomorrow is $\frac{1}{5}$, then the probability that it will ***not*** rain tomorrow is:

(A) $\frac{1}{5}$ **(B)** $\frac{4}{5}$ **(C)** 1 **(D)** $\frac{5}{4}$

10. The scale on an architect's plan is 1cm to 2 m. A length of 5.2 metres would be represented on the plan by

(A) 104 mm **(B)** 2.6 cm **(C)** 10.4 mm **(D)** 2.6 mm

11.



Not to scale

The diagram shows a yard that consists of a rectangle split into two trapezia.

Find the shaded area to the nearest square metre.

~~(A) 1500 (B) 2500 (C) 3500 (D) 5000~~

(A) 1500 **(B)** 2500 **(C)** 3500 **(D)** 5000

12. The 'time and a half' rate of pay for casual work in a salon is $18.60 per hour. What is the normal rate of pay per hour?

(A) $9.30 **(B)** $12.30 **(C)** $12.40 **(D)** $13.95

13. A water drop lands in a pond and a circular wave is created. The wave moves outwards away from the centre at a speed of 1.5 m/s.

What is the length of the circumference of the circular wave after 5 seconds?

(A) 7.5 m **(B)** 37.5 m **(C)** 47.1 m **(D)** 176.1 m

14. Savanah buys a lounge suite for $3150 on interest-free terms over 1.5 years. She pays 15% deposit and makes monthly repayments, repaying the balance owing in full after 1.5 years.

What is the size of each of Savanah's monthly repayments?

(A) $148.75 **(B)** $175.00 **(C)** $201.25 **(D)** $210.00

15. Eric owns 360 shares in an IT company. He paid $2.80 each for the shares and they are valued at $5.40 now. Eric received a dividend of $342.

What was the dividend yield on the current market value of the shares?

(A) 2.9% **(B)** 5.7% **(C)** 17.6% **(D)** 33.9%

16. An estimate of a person's maximum heart rate, R (in beats per minute) is given by the formula:

$$R = 220 - A \qquad \text{(where, } A \text{ is the person's age in years)}$$

It is estimated that a healthy person should have a heart rate of 55% of their maximum rate when beginning exercise.
Kristie is 17 years and 6 months.

What is an estimate of her heart rate, in beats per minute, when she begins exercising?

(A) 3.7 **(B)** 103.5 **(C)** 111.4 **(D)** 215.9

17. Sally made two errors in her solution to the following equation:

$$\frac{-3x}{x-4} = -5$$
$$-3x = -5(x-4) \quad \ldots\ldots Line\,1$$
$$-3x = -5x - 20 \quad \ldots\ldots Line\,2$$
$$-2x = -20 \quad \ldots\ldots Line\,3$$
$$x = 10 \quad \ldots\ldots Line\,4$$

Which two lines do not follow correctly from the previous line?

(A) Line 1 and Line 2
(B) Line 1 and Line 3
(C) Line 2 and Line 3
(D) Line 3 and Line 4

18. How much must be invested now (present value), at 8% p.a. compounding quarterly for 5 years if the future value is $20 000?

(A) $4 290.96 **(B)** $29 718.95 **(C)** $13 611.66 **(D)** $13 459.43

19. Simplify $8m^2c \div 4m^2c^2$

(A) $2c$
(B) $\frac{2}{c}$
(C) $\frac{c}{2}$
(D) $2m^0$

20. Cassie invests $2 500 in an investment account which pays interest at 8%p.a., compounded every six months. How much **interest** has she made after 6 years?

(A) $1 467.19 **(B)** $3 967.19 **(C)** $1 502.58 **(D)** $4 002.58

21. A jacket originally selling for $60 is reduced to $40. A further discount of 25% is then given.

What is the total percentage discount given?

(A) 35% **(B)** 45% **(C)** 50% **(D)** 58.3%

22.

The Future Value of $1					
Periods	*Interest rate per period*				
	1%	5%	10%	15%	20%
1	1.010	1.050	1.100	1.150	1.200
2	1.020	1.103	1.210	1.323	1.440
3	1.030	1.158	1.331	1.521	1.728
4	1.041	1.216	1.461	1.750	2.074
5	1.051	1.276	1.611	2.011	2.488
6	1.062	1.340	1.772	2.313	2.986

Jade invested $3000 for 6 years compounded annually at 5% p.a. Which calculation will give the amount of interest he will earn on the investment?

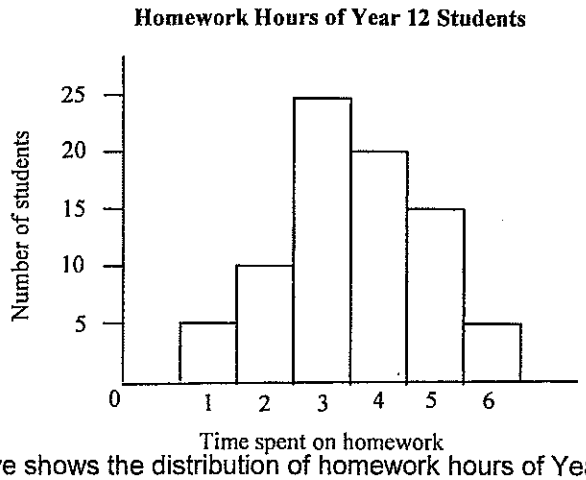
(A) 3000×1.340 **(B)** $3000 \times 1.340 \times 6$ **(C)** $3000 - 3000 \times 1.340$ **(D)** $3000 \times 1.340 - 3000$

End of Section I

SECTION 2

Question 23 (13 marks) Write answers in the booklet provided. Marks

(a)

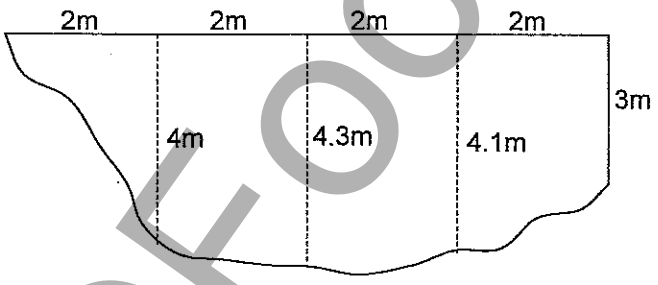


The graph above shows the distribution of homework hours of Year 12 students on a given night.

(i) How many students were surveyed? **1**

(ii) Find the probability that a student, chosen at random, spends more than four hours on homework. **1**

(b) A canal has cross-section as shown below. All measurements are in metres. **2**



Find the area of the cross-section using 2 applications of Simpson's rule.

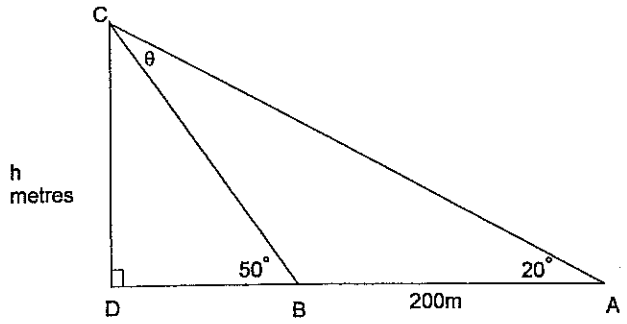
(c) Phoebe's fruit bowl contains 5 bananas, 4 apples, 1 orange and 5 peaches.
If she chooses one piece of fruit at random from the bowl, what is the probability that she will choose:

(i) a peach ? **1**

(ii) not a banana or an orange? **1**

(d) In the past, car number plates consisted of two letters followed by three digits. **2**
Find how many different number plates could be made if the plate had to start with a **T** and the numbers could ***not*** be repeated.

(e) A boat sails for 200m from A to B. The angle of elevation from A to the top of the cliff C is 20° and the angle of elevation from B is 50°.



(i) Explain why θ is 30°. **1**

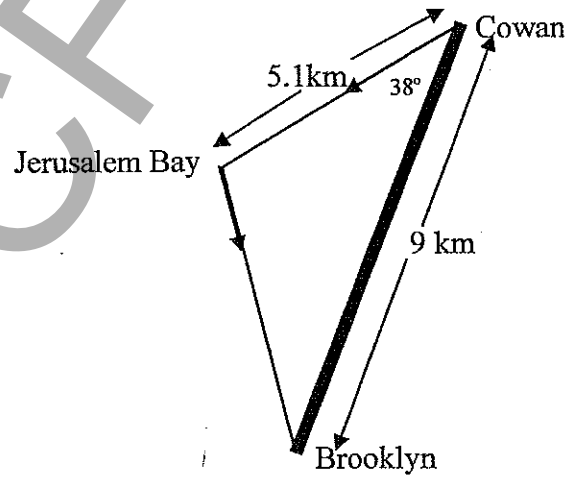
(ii) Find length CB to the nearest metre. **2**

(iii) Find the height of the cliff to the nearest metre. **2**

End of Question 23

Question 24 (13 marks) **Write answers in the booklet provided.** **Marks**

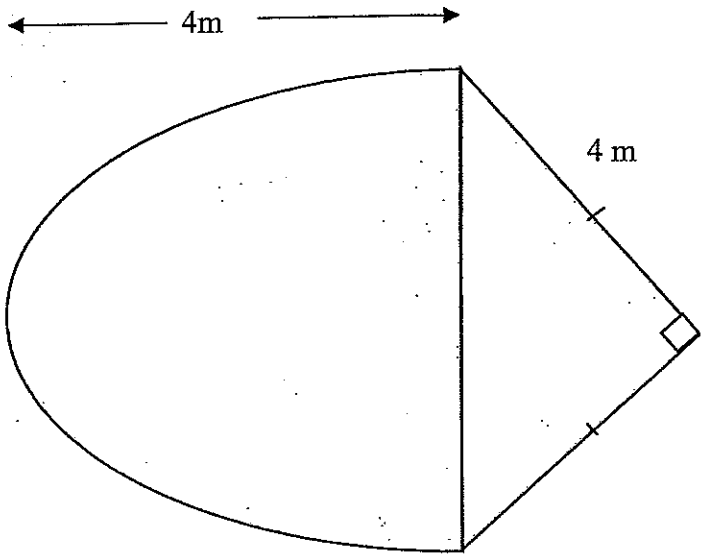
(a) Cowan Rural Fire Brigade organised a fun run along two straight fire trails from Cowan to Brooklyn via Jerusalem Bay. It is 9km along the highway from Cowan to Brooklyn.



(i) Calculate the distance from Jerusalem Bay to Brooklyn. **2**

(ii) The winning team time was 100 minutes.
Find their average speed for the fun run in km/h. **2**

(b) The surface of an ornamental lily pond, with constant depth, is composed of a semi-ellipse with major axis 8 m and a right isosceles triangle with two equal sides of 4 m.



Not to scale

(i) Show that the surface area of the pond is close to $26\ m^2$. **2**

(ii) When the pond is full it contains 50 000L of water.
Calculate the depth of the pond. ($1\ m^3 = 1000\ L$) **1**

(iii) For every 1 cm length of fish a volume of 20L is required.
How many 10 cm fish can fit in the pond? **1**

(c) The table below shows the number of goals scored in a series of soccer games.

Goals	0	1	2	3	4	5	6
Frequency	14	10	12	5	4	2	1

(i) What was the total number of matches played? **1**

(ii) Calculate the standard deviation correct to one decimal place. **1**

(iii) Give the 5 figure summary for this soccer team. **1**

(iv) Draw a box-and-whisker plot for this data. **2**

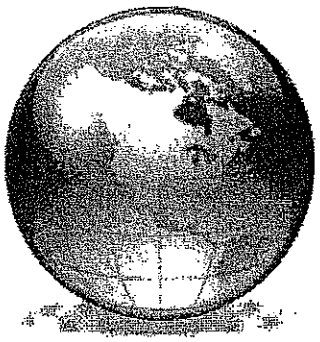
End of Question 24

Question 25 (13 marks) **Write answers in the booklet provided.** **Marks**

(a) 600 fish were caught from a lake, tagged and released back into the lake. A year later a sample of 100 fish was caught and 8 were found to be tagged. Use this information to estimate the number of fish in the lake. **2**

(b)

Water covers about 70% of the Earth's surface. Assuming the radius of the Earth is 6400km, Calculate the area of the Earth's surface that is occupied by land in square kilometres. **2**



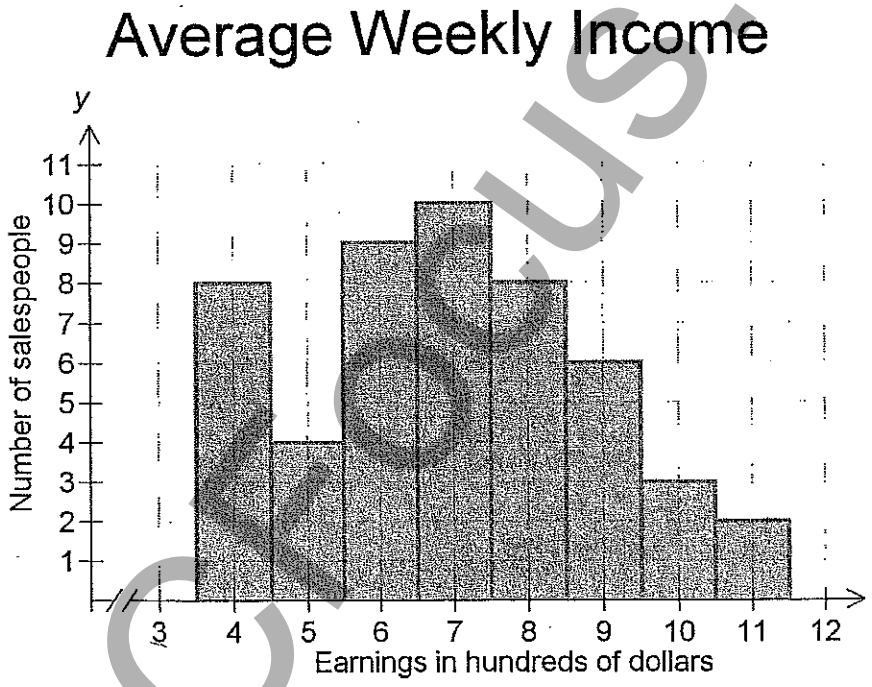
(c)

Matthew measures the perimeter of his new rectangular house. He finds it is 15m by 20m to the nearest metre.

(i) What is the maximum error in these measurements? **1**

(ii) What is the minimum area of the house? **2**

(d) In order to assess commission being paid to its salespeople, a company completed the following histogram.



(i) Complete the frequency table in your answer booklet. **2**

(ii) On the axes provided, draw a cumulative frequency histogram and ogive. **2**

(iii) Show clearly on your graph how you use it to find the median earnings for a salesperson. **1**

(iv) What is the median earnings? **1**

End of Question 25

Question 26 (13 marks) Write answers in the booklet provided.

Marks

(a) Natalie earns $2025 a fortnight.

(i) Calculate her annual pay. 1

(ii) Natalie receives 17.5% leave loading for her four weeks annual holidays. Calculate her four week pay including her leave loading. 2

(iii) Natalie's pay is deposited directly into her account; FID for deposits is 0.06%. Calculate the total amount of FID paid for one year. 1

(b) Khan wants to buy some office furniture that is valued at $7000

(i) A store requires 25% deposit. Calculate the deposit. 1

(ii) The balance is to be paid in 24 equal monthly instalments. No interest is charged. Determine the amount of each instalment. Write your answer to the nearest cent. 1

(c) Another store offers the same $7000 office furniture for $500 deposit and 36 monthly instalments of $220.

(i) Determine the total amount paid for the furniture at this store. 1

(ii) Calculate the **annual flat rate** of interest charged by this store. Write your answer as a percentage correct to one decimal place. 2

(d) A store owner finds that the number of televisions sold each week, N, decreases as the price, P, increases. This relationship can be given by the rule $N = 200 - 0.2P$.

(i) How many televisions will be sold if they are priced at $900 each? 1

(ii) The store can only sell a maximum of 50 televisions each week. At what price should the televisions be priced? 1

(e) Solve the following equation:

$$\frac{(x-3)}{3} - \frac{2(x-2)}{5} + 3 = x - 1$$ 2

End of Question 26

Question 27 (13 marks) Write answers in the booklet provided.

Marks

(a) Below is a copy of Peter's credit statement.

OzExpress Credit Card Statement

Account Name	PETER SUI		Account No.	3141 5926 5358 9793
Statement period	Start 13 DEC 01		Opening Balance	231.84
	End 13 JAN 02			
Date		Transaction details		Amount
16 DEC 01		COPPERART MCRTHR SQ AMBARVALE		39.95
18 DEC 01		BP CASULA		25.00
18 DEC 01		GRACE BROS LIVERPOOL		63.75
21 DEC 01		GRACE BROS WOLLONGONG		49.90
24 DEC 01		DAVID JONES WOLLONGONG		20.50
24 DEC 01		GRACE BROS WOLLONGONG		31.75
29 DEC 01		COLLINS BOOKS MIRANDA		49.90
29 DEC 01		LIVING HARMONY MIRANDA		37.45
29 DEC 01		TARGET MIRANDA		27.40
02 JAN 02		ATM CASH WITHDRAWAL MCRTHR SQ AMBARVALE		100.00
05 JAN 02		PAYMENT — THANK YOU		200.00 CR
07 JAN 02		INTEGRAL ELECTRICITY WOLLONGONG		54.25
13 JAN 02		CREDIT CHARGES PURCHASES		11.28
13 JAN 02		GOVERNMENT CHARGES (FID)		0.09
			Closing Balance	538.06
			Minimum Payment	16.14
			Due Date	07 FEB 02
Credit Limit	2000.00		Annual Percentage Rate	16.95
Available Credit	1461.94		Daily Percentage Rate	0.046438

(i) On what day did Peter go to Target? **1**

(ii) How long is the statement period? (Including the start date and end date) **1**

(iii) How many purchase transactions did Peter make? **1**

(iv) What percentage is the minimum payment of the closing balance? **2**

(v) What percentage of the credit limit is remaining on this statement? **2**

(b) Warren has the choice of two superannuation accounts.
Account 1 has an interest rate of 9% p.a. compounded annually.
Account 2 has an interest rate of 0.7% per month compounded monthly.

If Warren chooses account 1, he will deposit $12 000 on January 2 each year.
If Warren chooses account 2, he will deposit $1000 on the second day of each month.

Warren plans to contribute to the superannuation account he selects for the next 25 years.

Which account will give him the better return? Use calculation to support your answer. **3**

(c) Jasmine has borrowed $150 000 at an interest rate of 0.8% per month, interest compounded monthly.

The repayments have been set at $1800 per month.

The loan balance sheet below shows the interest charged and the balance owing for the first month of the loan.

Month	Principal (At the start of the month)	Monthly Interest Charged	Monthly Payment	Balance (Owing at the end of the month)
1	$150 000	$1200	$1800	X
2		Y	$1800	Z

Calculate the value of X, Y and Z in the table. 3

End of Question 27

Question 28 (13 marks) Write answers in the booklet provided.

Marks

(a) Kathleen applies for a $350 000 mortgage to be paid off over 20 years with **monthly** repayments. In June the interest rate was 8.97%p.a

(i) Calculate Kathleen's monthly repayment for June at 8.97% p.a. **1**

(ii) If just before Kathleen took out the loan the Reserve Bank increased the rate by 0.15%p.a.
Show that the increase in Kathleen's monthly repayments is $33.81. **2**

(iii) How much more does Kathleen have to pay back over the entire term of the loan. **1**

(b) A business replaces its computer system with a new system. The cost of the new system is $375 000.
The system was installed in January, 2007 and then depreciated at 32% of its value each year.

(i) What was the depreciated value of the system in January, 2008? **2**

(ii) What will the system's value be in January, 2009? **1**

(iii) In what year will its depreciated value be $8000? (You may use trial and error.) **2**

(c) Leanne and William are considering taking out a home loan of $350 000. The interest rate is 6.0% p.a., compounding monthly. The length of the loan is 25 years.

(i) Find the monthly repayment. **2**

(ii) Both Leanne and William agree that they will take out the loan if repayments are no more than 25% of their gross salary. Their combined gross salary is $102 000.

Should they take out the loan? Justify your answer with suitable calculations. **2**

End of Question 28

General Mathematics Formulae Sheet (page 1 of 2)

Area of an annulus

$A = \pi\left(R^2 - r^2\right)$

R = radius of outer circle
r = radius of inner circle

Area of an ellipse

$A = \pi ab$

a = length of semi-major axis
b = length of semi-minor axis

Area of a sector

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

θ = number of degrees in central angle

Arc length of a circle

$l = \dfrac{\theta}{360}2\pi r$

θ = number of degrees in central angle

Simpson's rule for area approximation

$A \approx \dfrac{h}{3}\left(d_f + 4d_m + d_l\right)$

h = distance between successive measurements
d_f = first measurement
d_m = middle measurement
d_l = last measurement

Surface area

Sphere $A = 4\pi r^2$
Closed cylinder $A = 2\pi rh + 2\pi r^2$

r = radius
h = perpendicular height

Volume

Cone $V = \dfrac{1}{3}\pi r^2 h$

Cylinder $V = \pi r^2 h$

Pyramid $V = \dfrac{1}{3}Ah$

Sphere $V = \dfrac{4}{3}\pi r^3$

r = radius
h = perpendicular height
A = area of base

Sine rule

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

Area of a triangle

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

Cosine rule

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

or

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

General Mathematics Formulae Sheet (page 2 of 2)

Simple interest

$I = Prn$

P = initial quantity
r = percentage interest per period, expressed as a decimal
n = number of periods

Compound interest

$A = P(1+r)^n$

A = final balance
P = initial quantity
n = number of compounding periods
r = percentage interest per compounding period, expressed as a decimal

Future value (A) of an annuity

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

M = contribution per period, paid at the end of the period

Present value (N) of an annuity

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

or

$$N = \frac{A}{(1+r)^n}$$

Straight-line formula for depreciation

$S = V_0 - Dn$

S = salvage value of asset after n periods
V_0 = purchase price of the asset
D = amount of depreciation apportioned per period
n = number of periods

Declining balance formula for depreciation

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

S = salvage value of asset after n periods
r = percentage interest rate per period, expressed as a decimal

Mean of a sample

$$\bar{x} = \frac{\sum x}{n}$$

$$\bar{x} = \frac{\sum fx}{\sum f}$$

$\bar{x}$ = mean
x = individual score
n = number of scores
f = frequency

Formula for a z - score

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

s = standard deviation

Gradient of a straight line

$$m = \frac{\text{vertical change in position}}{\text{horizontal change in position}}$$

Gradient-intercept form of a straight line

$y = mx + b$

m = gradient
b = y-intercept

Probability of an event

The probability of an event where outcomes are equally likely is given by:

$$P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$