2003

CRANBROOK SCHOOL

YEAR 12
TRIAL EXAMINATION

General Mathematics

General Instructions
* Working time – 2.5 hours.
* Write using blue or black pen.
* Graphics calculators may be used.
* Write your student number on the
  top of this page and circle teacher.
* A Formulae sheet is provided
  at the back of this paper.
* Detach Multiple-Choice answer
  sheet and write your student number
  on it and circle your teacher.

Section I
* Total marks (22)
* Attempt Questions 1-22 on answer sheet.
* Allow about 30 minutes for this section.

Section II
* Total marks (78)
* Attempt Questions 23, 24 & 25 in an 8-page booklet
* Attempt Questions 26, 27 & 28 in an 8-page booklet
* Extra booklets are available.
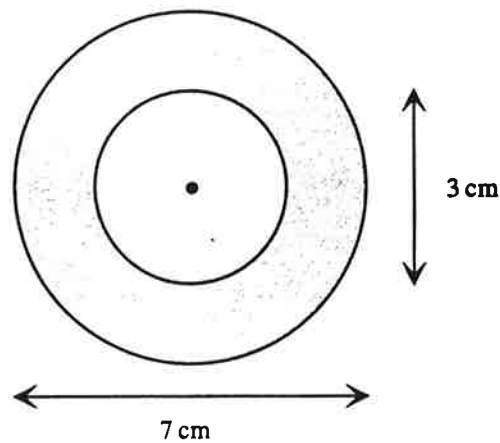* Allow about 2 hours for this section.

Select the most appropriate answer to each of the following. Enter your response on the attached answer sheet.

1   Which of the following calculations will correctly give the area of the ellipse drawn below?
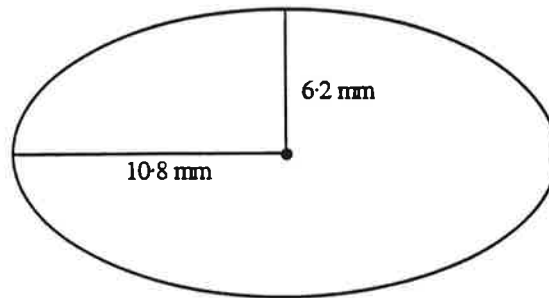
(A) $\pi \times 6.2^2$ (B) $\pi \times 12.4 \times 21.6$

(C) $\pi \times 10.8^2$ (D) $\pi \times 10.8 \times 6.2$

2   The area of the shaded annulus is closest to:
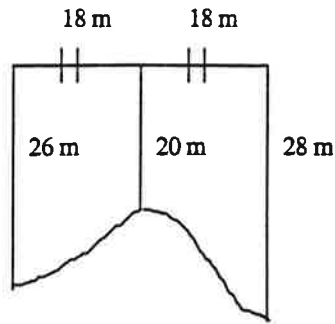

(A) $4\ cm^2$ (B) $31.4\ cm^2$

(C) $125.6\ cm^2$ (D) $125.7\ cm^2$

3   The number of matches in a box is approximately normally distributed with a mean of 50 and standard deviation of 1.
Approximately 95% of boxes will have between:

(A)   49 and 51 matches   (B)   48 and 52 matches

(C)   47 and 53 matches   (D)   46 and 54 matches

4   Using Simpson's rule, the area of the field below is closest to:

18 m   18 m

26 m   20 m   28 m

(A) $600\ m^2$ (B) $700\ m^2$

(C) $800\ m^2$ (D) $900\ m^2$

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5   Consider the stem and leaf plot below.

Stem	Leaf
1	2
2	1 3 5 5
3	1 3 4 5 6
4	6 6 6 6 7
5	5 8

The **median** and **mode** for this set of data is:

(A)   34 and 6   (B)   35 and 6

(C)   35 and 46   (D)   36 and 46

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6   When v is made the subject of the formula $E = \frac{1}{2}mv^2$ the result is:

(A) $v = \pm\sqrt{\dfrac{2E}{m}}$ (B) $v^2 = \dfrac{2E}{m}$

(C) $v = \pm\sqrt{\dfrac{m}{2E}}$ (D) $m = \dfrac{2E}{v^2}$

7 Gavin, Dion, Michael, Owen and Shane try out for two places on a tennis doubles team.
The number of teams that can be chosen is:

(A) 5
(B) 10
(C) 20
(D) 25

8 A bag contains four black and six white marbles. Two marbles are drawn from the bag one after the other.
If the first marble drawn is black, the probability that the second marble drawn is white is:

(A) $\dfrac{4}{9}$ (B) $\dfrac{2}{5}$ (C) $\dfrac{2}{3}$ (D) $\dfrac{3}{5}$

9 When fully simplified, $4k(5z+2)-2k(4z-3)$ is the same as:

(A) $12kz+14k$
(B) $26k^2z$
(C) $10k^2z$
(D) $12kz-2k$

10 $8.37\times10^5\, mg$ in tonnes is:

(A) 8.37×10^{14}
(B) 8.37×10^{2}
(C) 8.37×10^{-1}
(D) 8.37×10^{-4}

11 The volume of a rectangular pyramid with base dimensions 12 m by 17 m and height 7 m is:

(A) $1428\,m^3$
(B) $476\,m^3$
(C) $315\,m^3$
(D) $122\,m^3$

12 Frank has a credit card with an interest rate of 0.045% per day and no interest-free period. Frank used the credit card to pay for car repairs costing $575. He paid the credit card account 15 days later. What is the total amount (including interest) that he paid for the repairs?

    (A) $578.88   (B) $388.13   (C) $963.13   (D) $575.26

13 Calculate the present value of an annuity in which $1300 is invested at the end of every year for 12 years and interest is paid annually at a rate of 8% pa. (Answer to the nearest dollar).

    (A) $24 670   (B) $3 274   (C) $9 797   (D) $9 796

14 A photocopier purchased for $9400 is depreciated over 3 years at 16% per year using the declining-balance method. The salvage value of the photocopier is:

    (A) $14 672.42   (B) $4 515   (C) $38.50   (D) $5 571.42

15 A kite is 10 m off the ground and the string makes an angle of 30° with the horizontal. The length of the string to the nearest metre is:

    (A) 10 m   (B) 13 m   (C) 20 m   (D) 22.13 m

16 During a stunt show two aeroplanes fly side by side until they suddenly diverge at an angle of 160°. After both planes have flown 500 m what is the distance between them, correct to the nearest km?

    (A) 970 km   (B) 1 km   (C) 985 km   (D) 0.9 km

17 Given the formula $A = \dfrac{h}{2}(a+b)$, the value of a when $A = 145$, $h = 7.25$ and $b = 25$ is:

    (A) 616.25   (B) 15   (C) -25   (D) 257.75

18
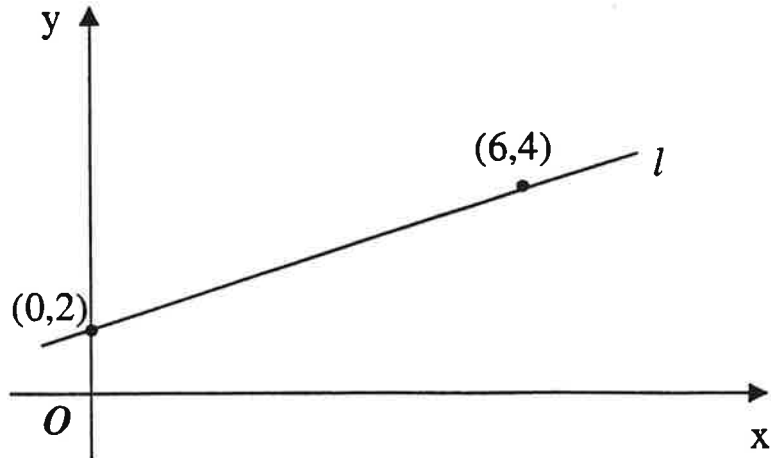
What is the equation of the line l?

(A) $y = \dfrac{1}{3}x + 2$ (B) $y = x + 6$

(C) $y = 3x + 2$ (D) $y = \dfrac{1}{3}x + 6$

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19   The table below shows monthly repayments for loans over 30 years.

Interest rate per annum	Loan amount			
	$100 000	$150 000	$200 000	$250 000
5.0%	$537	$806	$1074	$1343
5.5%	$568	$852	$1136	$1420
6.0%	$600	$900	$1200	$1499
6.5%	$633	$949	$1265	$1581
7.0%	$666	$998	$1331	$1664
7.5%	$700	$1049	$1399	$1749

James borrows $200 000 over a period of 30 years at 6.5% per annum. Repayments are to be made monthly according to the table. How much would James repay over 30 years if the interest rate were to remain the same?

(A) $1265   (B) $37 950   (C) $390 000   (D) $455 400

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20   A plumber purchases equipment for a total of $60 000. The value of the equipment is depreciated by $7500 per year. When the value of the equipment falls below $10 000 it should be replaced. Calculate the number of years (to the nearest whole year) after which the equipment should be replaced.

(A)   6.7   (B)   6.6   (C)   7   (D)   6

21 Which of the following functions is **not** a quadratic function?

(A) $y = x^2 + 5x - 4$
(B) $y = (x - 4)^2$
(C) $y = (x - 2)(x + 2)$
(D) $y = \dfrac{x-2}{x+2}$

22 The equation of the graph shown below could be
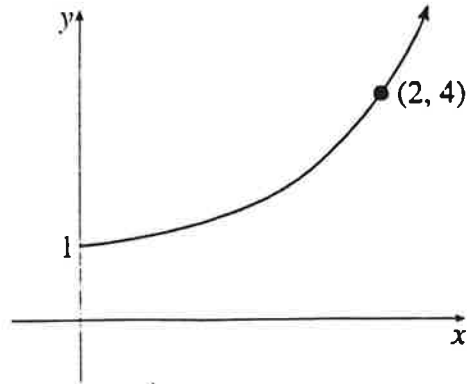
(A) $y = 2x$ (B) $y = x^2$ (C) $y = 2^x$ (D) $y = \dfrac{4}{x}$

End of Section I

Section II
78 marks
Attempt Questions 23-28.
Allow about 2 hours for this section.
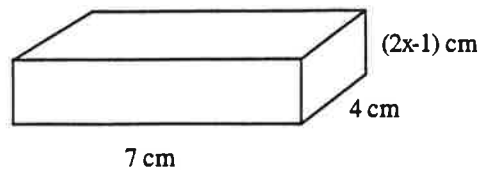* Attempt Questions 23, 24 & 25 in an 8-page booklet.
* Attempt Questions 26, 27 & 28 in an 8-page booklet.
* Extra booklets are available.
* Approved calculators may be used.

Question 23 (13 marks) (Use a SEPARATE writing booklet) (marked by DGK)

(a)   A peanut and chocolate bar is made in the shape of a rectangular prism 7 cm long, 4 cm wide and $(2x-1)$ cm high.

The volume of this bar is $42\ cm^3$.

(i)   Find the value of x.   **3**

(ii)   The peanut and chocolate bars are to be packed in a cylindrical party pack   **2**
       with a radius of $6x\ cm$ and a height of $20x\ cm$.
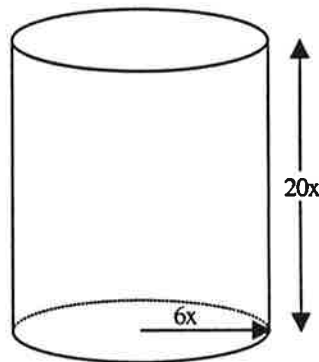
What is the volume of the cylindrical party pack?
Give your answer correct to the nearest cubic centimetre.

(iii) Toby said that the party pack would hold 105 peanut and chocolate bars.   **2**
       Is Toby correct? Give a reason for your answer.

(b)   Riley and his Geography class went to two large city parks and measured the heights of the trees in metres.
In South Park there were 25 trees. In West Park there were 27 trees.
The data sets were displayed in two box-and-whisker plots.

South Park

West Park

0   2   4   6   8   10   12   14   16   18   20   22

Tree height (metres)
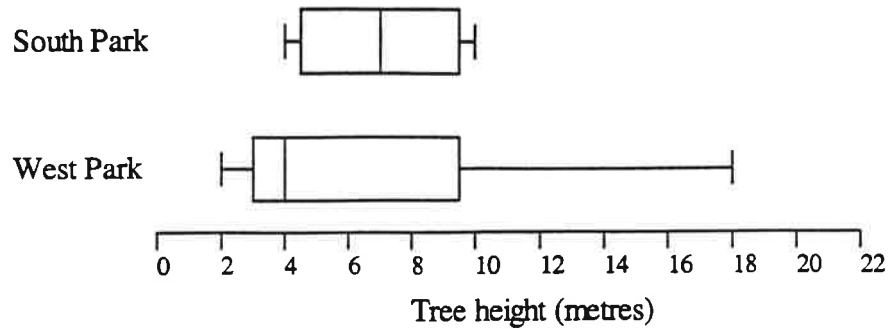
(i)   In which park is the smallest tree, and how high is it?   2

(ii)   What is the median height of trees in South Park?   1

(iii)   Compare and contrast the two data sets by examining: 3
        * the shape and skewness of the distributions,
        * the measures of location, and
        * the measures of spread.

Question 24 (13 marks) (marked by DGK)

(a)   Talia received a threatening letter. It is being analysed by the police in an attempt to identify the writer. The number of words per sentence has been counted. These data are summarised in the following table.

Number of words per sentence	Frequency
2	2
3	3
4	6
5	6
6	7
7	5
8	4
9	4
10	3
Total	40

(i)   How many sentences were in this letter?   1

(ii)   How many sentences contained more than five words?   1

(iii)   Calculate the mean number of words per sentence, and the standard deviation.   2

(iv)   Talia received a second letter. The police suspect that this second letter was   1
        written by a different person, because the sentences were longer on average
        and more consistent in length.
        Write a statement comparing the mean number of words per sentence and the
        standard deviation for the second letter to your results in part (iii).

(b)   Three men and two women remain in the *Big Brother house*. Two people will soon be randomly selected by Big Brother for eviction instead of being voted out by the general public which is the usual way that the housemates are evicted.

(i) If one person is selected at random, what is the probability that this person is male?   **1**

(ii) Two people are to be randomly selected for eviction from the *Big Brother* house.

1. Copy the tree diagram, and complete the diagram by writing the probabilities on all the branches.   **2**
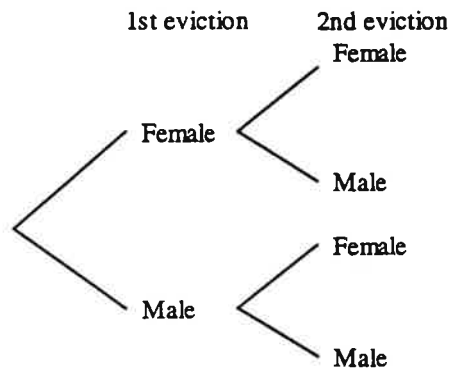
2. Calculate the probability that the selection includes exactly one female.   **2**

(iii)   Regina is one of the women in the *Big Brother* house. Before the two people are randomly selected for eviction, Regina calculates her chance of remaining in the *Big Brother* house.   **2**
She concludes that she has 'a better than even chance' of remaining.
Do you agree? Justify your answer.

Question 25 (13 marks) (marked by DGK)

(a)   Solve: (i) $10 - 3(2k - 1) = 1$ **2**

(ii) $\dfrac{1}{2}\sqrt{2x - 1} = 4$ **2**

(b)   Inflation in the Coconut Islands was 9%. In the year 2000 a can of soft drink cost $1.65.   **2**
Use the formula $P = 1.65(1.09)^n$ where P is the price of a can of soft drink and n is the number of years after the year 2000, to find in what year the price of a can of soft drink will reach $4.00.

(c)   The results of two language tests are shown.   **2**

	Mean	Standard Deviation
Japanese	70	8
German	65	12

Alexander scored 82% in the Japanese test and 89% in the German test.
In which of the two tests has Alexander performed better? Give reasons for your answer.

(d)   The label on packets of chocolate biscuits states the contents are 500 grams.   **5**
When Tom weighed a sample of packets he found they had a mean weight of 505 g
with a sample standard deviation of 2 g.

    (i)   Copy and complete this table of values.

Mass of packets in grams	499	501	503	505	507	508
z-score				0	1	

    (ii)   What percentage of the packets have a mass between 503 g and 507 g.

    (iii)   What percentage of the packets have a mass between 505 g and 509 g?

    (iv)   The manufacturer guarantees the packets have a mass of 501 g or more.
What percentage of the packets fail to meet this guarantee?

Question 26 (13 marks) (Use a SEPARATE writing booklet) (marked by ZRG)

(a)   Substitute $x = -2$ and $y = -3$ into $m = \sqrt{2xy} + y^3$ and give your   **2**
answer correct to 2 decimal places.

(b)   By means of a table, and using estimation and refinement, show how   **2**
you would solve the following equation:

$$3x^2 - 4x = 26.$$

Give your answer correct to 1 decimal place.

(c)   Using a table and a suitable scale, draw the graphs of the linear   **5**
functions $y = 7 - 2x$ and $x - 2y - 8 = 0$ on the same set of axes and
find the simultaneous solution to the equations graphically.

(d)   The mass, m, of an egg varies directly with the cube of its length, l.   **4**
An egg of length 5.5 cm has a mass of 75 g.

    (i)   Write an equation connecting m and l.

    (ii)   Find the mass of an egg with a length of 5 cm.

    (iii)   Find the length of a 50 g egg.

Question 27 (13 marks) (marked by ZRG)

(a) In the diagram below, A, B and C represent the locations of three towns. **4**
     The town B is due east of A and the bearing of C from B is 046°.
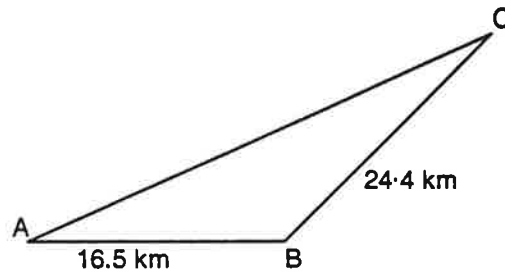
(i)   Find the size of ∠ ABC

(ii) Find the distance AC correct to 1 decimal place.

(iii) What is the bearing of B from C?

(b) When a yacht is 500m from the shore, the top of a cliff is sighted at an **5**
     angle of elevation of 12°. By drawing a clear diagram:

(i)   calculate the height of the cliff, correct to the nearest metre, and

(ii) calculate what the angle of elevation of the top of the cliff will be
      when the yacht is 200m from the shore. Answer to the nearest minute.

(c) The figure below is a plane table radial survey of a field. **4**
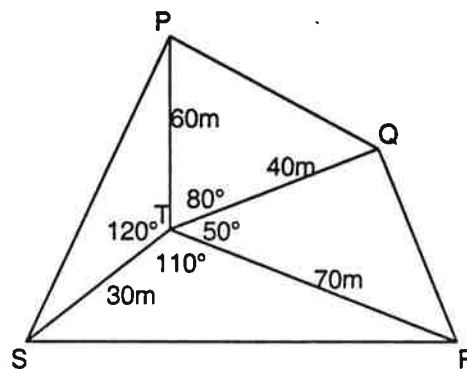
(i)   Calculate the length of the side SR to 1 decimal place.

(ii) Find the area of the section PTQ to 3 significant figures.

Question 28 (13 marks) (marked by ZRG)

(a)   Calculate the value of y, correct to 1 decimal place.   **2**

(b)   The following Home Loan Table shows how the repayments of a home loan progress.
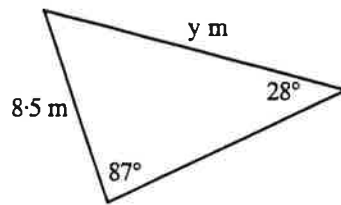The loan is $180 000 to be repaid over 15 years in equal monthly repayments with interest
fixed at 8.4% per annum calculated monthly. The monthly repayments are $1762.

Amount of loan = $180 000			Interest = rate /12 ×principal	
Annual interest rate = 8.4%				
Monthly repayment (R) = $1762				
N	Principal (P)	Interest (I)	P + I	P + I - R
1	$180 000.00	$1 260.00	$181 260.00	$179 498.00
2	$179 498.00	$1 256.49	$180 754.49	$178 992.49
3	$178 992.49	$1 252.95	$180 245.44	$178 483.44
4	$178 483.44	(iii)	$179 732.82	$177 970.82
5	$177 970.82	$1 245.80	$179 216.62	$177 454.62
6	$177 454.62	$1 242.18	$178 696.80	$176 934.80

(i)   What is the total amount that has been paid at the end of six months?   **1**

(ii)   How much has been paid off the loan at the end of six months?   **1**

(iii)   Complete the table by calculating the missing amount marked (iii).   **1**

(iv)   Calculate the total interest that will be paid during the 15 year life of the loan.   **3**

(c)   Sam invests $4000 into a savings account at the end of each year   **2**
for 6 years. The account pays interest at a rate of 5% per annum.
Calculate the future value at the end of 6 years. Give your answer to the nearest cent.

(d)   Determine the single amount to be invested today at 4.6% per annum   **3**
compounded monthly in order to provide for a series of monthly payments
of $582 for 20 years. Give your answer to the nearest dollar.

End of Section II

13

Section I – Multiple-Choice
* Total marks (22)
* Attempt Questions 1-22
* Allow about 30 minutes for this section

Student Number: _____

Circle Teacher: DGK   ZRG

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

Sample   2 + 4 = (A) 2   (B) 6   (C) 8   (D) 9

              A   O   B   ●   C   O   D   O

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

              A   O   B   ✗   C   ●   D   O

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

                                              ⌐ correct

              A   O   B   ✗   C   ✗   D   O

_____

Section I – Multiple-Choice Answer Sheet

Q1.	A O	B O	C O	D O
Q2.	A O	B O	C O	D O
Q3.	A O	B O	C O	D O
Q4.	A O	B O	C O	D O
Q5.	A O	B O	C O	D O
Q6.	A O	B O	C O	D O
Q7.	A O	B O	C O	D O
Q8.	A O	B O	C O	D O
Q9.	A O	B O	C O	D O
Q10.	A O	B O	C O	D O
Q11.	A O	B O	C O	D O
Q12.	A O	B O	C O	D O
Q13.	A O	B O	C O	D O
Q14.	A O	B O	C O	D O
Q15.	A O	B O	C O	D O
Q16.	A O	B O	C O	D O
Q17.	A O	B O	C O	D O
Q18.	A O	B O	C O	D O
Q19.	A O	B O	C O	D O
Q20.	A O	B O	C O	D O
Q21.	A O	B O	C O	D O
Q22.	A O	B O	C O	D O

FORMULAE SHEET

Area of an annulus

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

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

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

θ = number of degrees in central angle

Arc length of a circle

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

θ = number of degrees in central angle

Surface area of a sphere

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

Surface area of a cylinder
$$A = 2\pi r^2 + 2\pi rh$$

Simpson's rule for area approximation

$$A \approx \frac{h}{3}(d_f + 4d_m + d_l)$$

h = distance between successive
measurements

d_f = first measurement

d_m = middle measurement

d_l = last measurement

Volume

Cone	$V = \frac{1}{3}\pi r^2 h$
Cylinder	$V = \pi r^2 h$
Pyramid	$V = \frac{1}{3}Ah$
Sphere	$V = \frac{4}{3}\pi r^3$

A = area of base
h = perpendicular height

Mean of a sample

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

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

x = individual score

$\bar{x}$ = mean

n = number of scores
f = frequency

Formula for a z-score

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

s = standard deviation

Probability of an event

The probability of an event where

outcomes are equally likely is given by:

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

FORMULAE SHEET

Simple interest

$I = Prn$

$P =$ initial quantity

$r =$ percentage interest rate 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 rate 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

Sine rule

$$\frac{a}{sinA} = \frac{b}{sinB} = \frac{c}{sinC}$$

Area of a triangle

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

Cosine rule

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

or

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

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

<u>Section I</u> (Multiple Choice) answers

Q1.	D
Q2.	B
Q3.	B
Q4.	C
Q5.	C
Q6	A
Q7.	C
Q8	C
Q9.	A
Q10.	D
Q11.	B
Q12	A
Q13	C
Q14	D
Q15	C
Q16	B
Q17	B
Q18	A
Q19	D
Q20	C
Q21	D
Q22.	C

Multiple Choice worked answers:

Q1. $A = \pi ab = \pi \times 10.8 \times 6.2\, mm^2$ **(D)**

Q2. $A = \pi \times (3.5)^2 - \pi \times (1.5)^2 = 31.4\, cm^2$ **(B)**

Q3.

95% of all scores lie within 2 standard deviations

$\bar{x} - 2s = 50 - 2 \times 1 = 48,$ **(B)**

$\bar{x} + 2s = 50 + 2 \times 1 = 52.$

Q4. $A = \dfrac{18}{3}(26 + 4 \times 20 + 28) \approx 804\, m^2$ **(C)**

Q5. From graphics calculator: median=35, mode=46. **(C)**

Q6.

$E = \dfrac{1}{2}mv^2$

$2E = mv^2$

$v^2 = \dfrac{2E}{m}$ **(A)**

$v = \pm\sqrt{\dfrac{2E}{m}}$

Q7.   *No. of teams* $= 5 \times 4 = 20$ **(C)**

Q8. $P(second\ is\ white) = \dfrac{6}{9} = \dfrac{2}{3}$ **(C)**

Q9.

$4k(5z + 2) - 2k(4z - 3)$

$= 20kz + 8k - 8kz + 6k$ **(A)**

$= 12kz + 14k$

Q10. $8.37 \times 10^5\ mg = 8.37 \times 10^2\ g = 8.37 \times 10^{-1}\ kg = 8.37 \times 10^{-4}\ t$ **(D)**
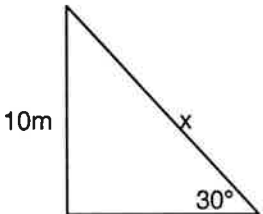
Q11.

$V = \dfrac{1}{3} Ah = \dfrac{1}{3} \times (12 \times 17) \times 7 = 476\,m^3$ **(B)**

Q12.   Total amount $= \$575 + 575 \times 0.00045 \times 15$
$= \$575 + 3.88$
$= \$578.88\ldots..$**(A)**

Q13.   Present Value N $= M \dfrac{\left\{(1+r)^n - 1\right\}}{r(1+r)^n}$ where M = 1300, r = 0.08 and n = 12

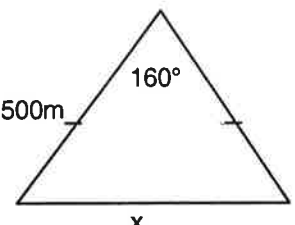$= \dfrac{1300\left(1.08^{12} - 1\right)}{0.08(1.08)^{12}}$

$= \$9796.90\ldots\ldots..$**(C)**

Q14.   Salvage value $= V_0(1 - r)^n$
$= 9400(1 - 0.16)^3$
$= \$5571.417\ldots\ldots$**(D)**

Q15.

$\dfrac{10}{x} = \sin 30^0$

$\therefore x = \dfrac{10}{\sin 30^0}$

$= 20\ m$ **(C)**

Q16.

$x^2 = 500^2 + 500^2 - 2(500)^2 \cos 160^\circ$
$= 984.807\ldots m$ **(B)**

Q17.　$A = \dfrac{h}{2}(a+b)$

$145 = \dfrac{7.25}{2}(a+25)$

$\therefore 290 = 7.25a + 181.25$

$\therefore 7.25a = 108.75$

$\therefore a = 15$　　**(B)**

Q18.　Eqn: $y - 2 = \dfrac{4-2}{6-0}x$

　　　　　　$= \frac{1}{3}x$

$\therefore y = \frac{1}{3}x + 2$　　**(A)**

Q19.　$\$1265 \times 30 \times 12 = \$455\,400$　　**(D)**

Q20.　$10\,000 = 60\,000 - 7500n$

$\therefore 7500n = 50\,000$

$\therefore \sqrt{12} - 27 \; n = \dfrac{50000}{7500}$

　　　　$= 6.66...$

　　　　$= 7$ years (nearest whole year)　　**(C)**

Q21.　**(D)**

Q22.　**(C)**

Section II answers

Q23.(a). (i)

$$Volume\ of\ bar = 7 \times 4 \times (2x-1)$$
$$42 = 28(2x-1)$$
$$42 = 56x - 28$$
$$70 = 56x$$
$$\therefore \; x = 1.25.$$

(ii)

$$radius = 6 \times 1.25 = 7.5\,cm$$
$$height = 20 \times 1.25 = 25\,cm$$
$$V = \pi r^2 h$$
$$V = \pi \times 7.5^2 \times 25$$
$$V = 4417.86...$$
$$V \approx 4418\,cm^3 \;(nearest\ cm^3)$$

(iii)

$$Volume\ of\ bars = 105 \times 42 = 4410\,cm^3$$

Toby is incorrect. Even though the volume of 105 bars is less than the $4418\,cm^3$ volume of the cylinder, they will not fit unless they are broken up. There will be wasted space in the cylinder because of its curved sides.

Q23. (b) (i)   The smallest tree is in West Park and it is 2 metres tall.

(ii)   7 metres.

(iii)   In comparing the shape, South Park trees had a symmetrical distribution, whereas West Park trees were positively skewed (looking at the shape of the box-and-whisker plot).

The median is a measure of location. The median height of trees in South Park is higher than the median height of trees in West Park.

The range and interquartile range (IQR) are measures of spread.
In West Park the range (18-2=16) and the IQR (9.5-3=6.5) are both higher than the range (10-4=6) and IQR (9.5-4.5=5) in South Park.
50% of trees in West Park are shorter than the shortest tree in South Park., even though West Park contains the tallest tree.

Q24. (a) (i)   40
     (ii)   7+5+4+4+3=23
     (iii)

$$\bar{x} = 6.05 \ (by \ calc.)$$

$$\sigma_n = 2.2017...(by \ calc.)$$

$$\sigma_n \approx 2.20.$$

(iv)   The mean would be greater in the second letter (longer sentences on average) and the standard deviation would be smaller (sentences more consistent in length).

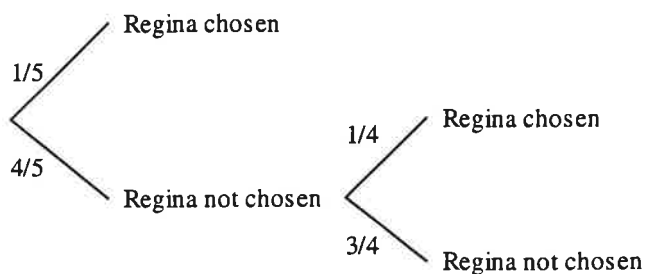Q24. (b) (i) $P(male) = \dfrac{3}{5}$

(ii)   1.
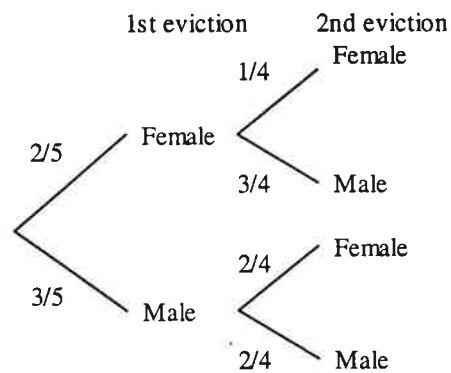
2.

$$P(exactly \ one \ female) = P(FM) + P(MF)$$

$$= \frac{2}{5} \times \frac{3}{4} + \frac{3}{5} \times \frac{2}{4}$$

$$= \frac{3}{5}.$$

(iii)

$$P(Regina\ not\ chosen) = \frac{4}{5} \times \frac{3}{4} = \frac{3}{5}$$

Yes, Regina has a 3 in 5 chance (60% chance) of remaining, which is a 'better than even chance'. (An even chance is a 50% chance).

Q25. (a) (i)

$$10 - 3(2k - 1) = 1$$
$$10 - 6k + 3 = 1$$
$$13 - 6k = 1$$
$$-6k = -12$$
$$k = 2$$

(ii)

$$\frac{1}{2}\sqrt{2x-1} = 4$$
$$\sqrt{2x-1} = 8$$
$$2x - 1 = 64$$
$$2x = 65$$
$$x = 32.5$$

Q25. (b) (i)

$$P = 1.65(1.09)^n$$
$$4 = 1.65(1.09)^n$$
$$2.4\overset{.}{2} = (1.09)^n$$

Try $n = 5, (1.09)^5 = 1.538623955...(Too\ small\,!)$

Try $n = 12, (1.09)^{12} = 2.812664782...(Too\ big\,!)$

Try $n = 10, (1.09)^{10} = 2.367363675...(close,\ but\ too\ small\,!)$

Try $n = 11, (1.09)^{11} = 2.580426405...(a\ bit\ big\,!)$

$\therefore$ *the soft drink will reach* $\$4.00$ *in the year* 2010.

Q25. (c)   Alexander's mark in German was better.
It had the higher z-score of 2, compared to the z-score of 1.5 for Japanese.

Q25. (d)

(i)

Mass	499	501	503	505	507	508
z-score	-3	-2	-1	0	1	1.5

(ii)   68%

(iii)   47.5%

(iv)   2.5%

Q26. (a) $m = \sqrt{2(-2)(-3)} + (-3)^3$ all leave out ( )   **(1)**

$= \sqrt{12} - 27$

$= -23.535....$

$= \underline{-23.54 \text{ (2dp)}}$ **(1)**

Q26. (b) $3x^2 - 4x = 26$

x	$3x^2 - 4x$
2	$3(2)^2 - 4(2) = 4$
3	$3(3)^2 - 4(3) = 15$
4	$3(4)^2 - 4(4) = 32$
3.5	$3(3.5)^2 - 4(3.5) = 22.75$
3.6	$3(3.6)^2 - 4(3.6) = 24.48$
3.7	$3(3.7)^2 - 4(3.7) = 26.27$
3.65	$3(3.65)^2 - 4(3.65) = 25.37$

$\therefore \underline{x = 3.7 \text{ (1dp)}}$ **(2)**

Q26. (c) $y = 7 - 2x$ **(1)**

x	0	3.5
y	7	0

$x - 2y - 8 = 0$ **(1)**

x	0	8
y	-4	0

At A the solution is approximately $\underline{(4.5, -2)}$ **(1)**
(Actual solution (4.4, -1.8))
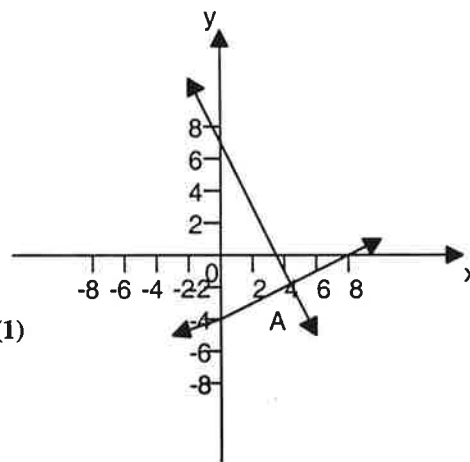
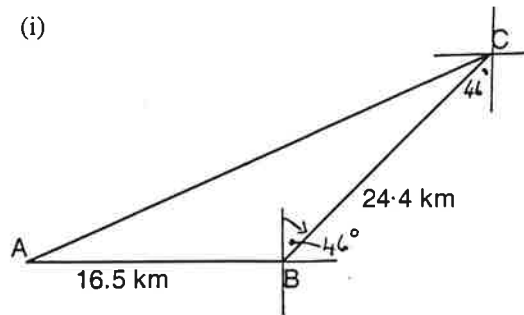**(2)**

Q26 (d) (i) $\dfrac{m}{l^3} = k$ **(1)**

$k = \dfrac{75}{5.5^3}$

$= \underline{0.45}$ **(1)**

(ii) $\dfrac{m}{5^3} = 0.45$

$\underline{m = 56.25}$ **(1)**

(iii) $\dfrac{50}{l^3} = 0.45$

$\underline{l = 4.8 \text{ (1dp)}}$ **(1)**

Q27 (a)   (i)

$\angle ABC = 90° + 46°$

$= \underline{136°}$ **(1)**

(ii) $AC^2 = 16.5^2 + 24.4^2 - 2(16.5)(24.4)\cos 136°$ **(1)**

$= 1446.82\ldots\ldots$

$\therefore \underline{AC = 38.0 \text{ km}} \text{ (1dp)}$ **(1)**

(iii)   The bearing of B from C is $180° + 46°$

$= \underline{226°}$ **(1)**

Q27 (b)

(1)
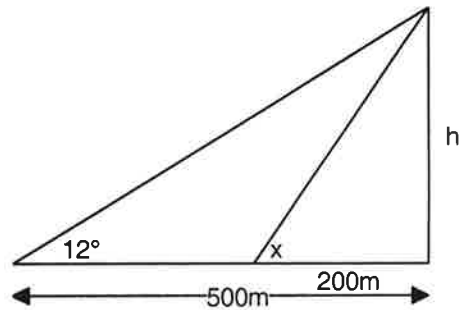
(i) $\dfrac{h}{500} = \tan 12^0$ **(1)**

$\therefore h = 106.278$

$= \underline{106\text{m}} \text{ (nearest m)}$ **(1)**

(ii) $\dfrac{106}{\dfrac{\cancel{500}}{200}} = \tan x^0$ **(1)**

$\underline{x = 27° \; 55'} \text{ (nearest minute)}$ **(1)**

Q27 (c) (i) $SR^2 = 30^2 + 70^2 - 2(30)(70)\cos 110°$ **(1)**
                $= 7236.48\ldots..$

                $\therefore \underline{SR = \ 85.1m}$ (1dp)   **(1)**

        (ii) $A = ½ (60)(40)\sin 80°$ **(1)**
                 $= 1181.76\ldots...$
                 $= \underline{1180m^2}$ (3sf)   **(1)**

Q28 (a) $\dfrac{y}{\sin 87^0} = \dfrac{8.5}{\sin 28^0}$ **(1)**

          $\therefore \ y = \dfrac{8.5\sin 87^0}{\sin 28^0}$

              $= \underline{18.1m}$ (1dp)   **(1)**

Q28 (b)   (i)   The total amount paid at the end of 6 months is
               $1762 \times 6 = \underline{\$10\ 572}$ **(1)**

        (ii)   The amount paid off the loan at the end of 6 months is
               $\$180\ 000 - \$176\ 934.80 = \underline{\$3\ 065.20}$ **(1)**

              OR $\$10\ 572 - (\$1\ 260 + \$1\ 256.49 + \$1\ 252.95 +$
                    $\$1\ 249.38 + \$1\ 245.80 + \$1\ 242.18)$
                    $= \$3\ 065.20$

        (iii)   Monthly interest rate is $0.084 \div 12 = 0.007$
               $\$178483.44 \times 0.007 = 1249.384$
               Therefore the missing figure in the table **(iii)** $= \underline{\$1\ 249.38}$ **(1)**

        (iv)   The total interest over the life of the loan is;
              Payment over 15 years $= \$1\ 762 \times 15 \times 12$
                    $= \$317\ 160$ **(1)**
              Loan is $\$180\ 000$ **(1)**
              Thus interest is $\underline{\$137\ 160}$ **(1)**

Q28 (c) $M = \$4000, n = 6, r = 5\% p.a. = 0.05, A = ?$ (future value)

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

          $A = \$4000\left\{\dfrac{(1.05)^6 - 1}{0.05}\right\}$ **(1)**

              $= \underline{\$27\ 207.65}$ (nearest cent)   **(1)**

Q28 (d) $M = \$582,$
          $n = 20 \times 12 = 240\, months,$
          $r = 4.6\% p.a. = 0.046 \div 12 = 0.00383\ldots.$ *per month*   **(1)**

          $N = ?$

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

          $N = \$582\left\{\dfrac{(1+0.00383)^{240} - 1}{0.00383(1+0.00383)^{240}}\right\}.$ **(1)**

            $= \$91\ 214.85$ ✓
            $= \underline{\$91\ 215}$ (nearest $) ✓   **(1)**