Student Number: …………..………………….…

2008

GENERAL MATHEMATICS

General instructions

- Reading time – 5 minutes
- Working time – 2.5 hours
- Write using blue or black pen
- Write your student number at the top of this page
- 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 II
78 marks
- Attempt Questions 23–28
- Allow about 2 hours for this section

Directions to school or college

Section I

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

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

---

1   What is 426 000 000 mg expressed in scientific notation?

A 4.26×10^{-8} mg
B 42.6×10^{-7} mg
C 4.26×10^{8} mg
D 42.6×10^{9} mg

2   The staff at a psychiatric hospital were interested in the relationship between the fraction of the moon's face showing at night and the number of 'new' psychiatric patients admitted. The scatter graph shows their data.
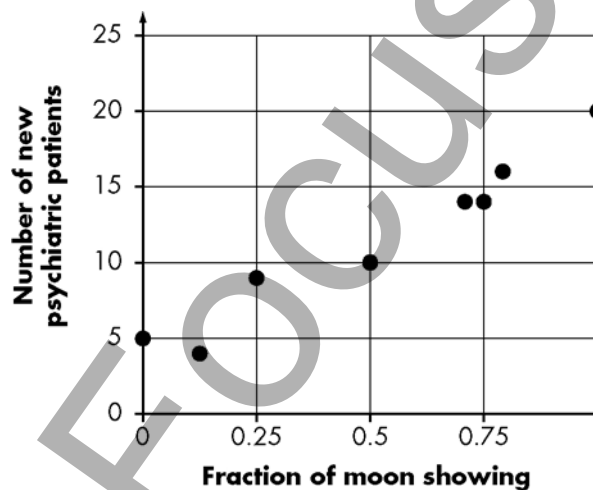
The correlation shown on the scatter graph is best described as

A   strong, negative, linear
B   strong, positive, non-linear
C   strong, positive, linear
D   no correlation

3   Bianca is taking her four weeks' annual leave next month. Her weekly salary is $475 and her holiday loading is $17\frac{1}{2}$ % of four weeks' pay.

Calculate Bianca's total pay for the four weeks of her annual leave.

A $83.13
B $332.50
C $1900
D $2232.50

4 What scale factor has been used to transform Triangle B to Triangle A?
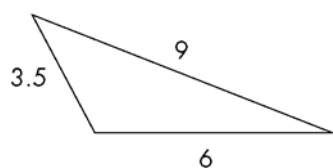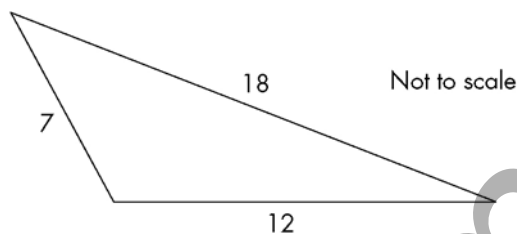
Triangle A   Triangle B

A $\dfrac{1}{2}$

B $\dfrac{7}{8}$

C   3

D   8

5 Brodie is paid $3.10 per hour to sell fruit and vegetables at the local fresh food market. He also gets 3% commission of the takings. Find his commission if the day's takings are $568.

A $3.10
B $5.50
C $17.04
D $1760.80

6 Calculate the length of *AC*, correct to one decimal place.
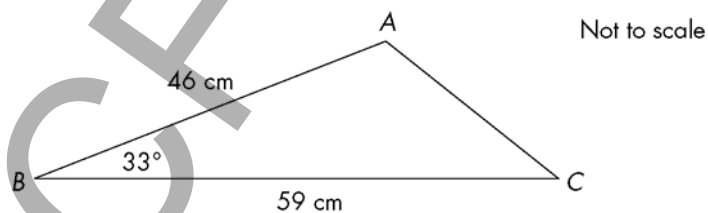
A   13.0 cm
B   32.3 cm
C   36.9 cm
D   1044.7 cm

7   Calculate the area of the ellipse, correct to four significant figures.

NOT TO SCALE

11 cm   4 cm   11 cm   4 cm
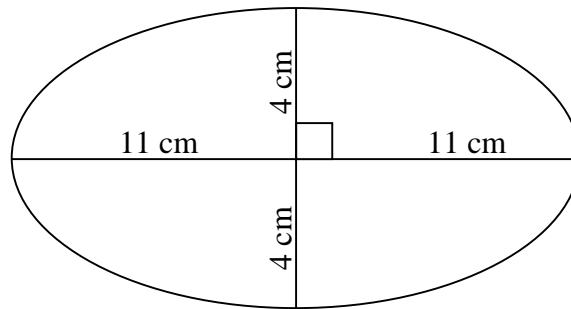
A   44.0 cm^2
B   138.2 cm^2
C   176.0 cm^2
D   552.9 cm^2

8   If a video store charges \$4.50 rental before GST and \$5.04 after GST, what percentage rate of GST is imposed?

A   10%
B   12%
C $17\dfrac{1}{2}$ %
D   89%

9   Calculate $\dfrac{5.86 \times 10^8}{6.12 \times 10^{-4}}$, correct to three significant figures.

A 95.7×10^{11}
B 95.8×10^{11}
C 9.57×10^{11}
D 9.58×10^{11}

10   There are 200 LEGO$^{®}$ bricks in a bucket. There are 63 blue bricks, 37 green bricks and 59 yellow bricks, and the remainder are red bricks. One brick is chosen at random. Find the probability that the brick is blue or red.

A $\dfrac{41}{200}$
B $\dfrac{63}{200}$
C $\dfrac{9}{25}$
D $\dfrac{13}{25}$

11 If the perimeter of a square is 23.2 cm, what is the area?

    A   5.8 cm^2
    B   33.64 cm^2
    C   134.56 cm^2
    D   538.24 cm^2

12 The graph shows the depreciation in the value of a plasma television.

Value of the plasma TV
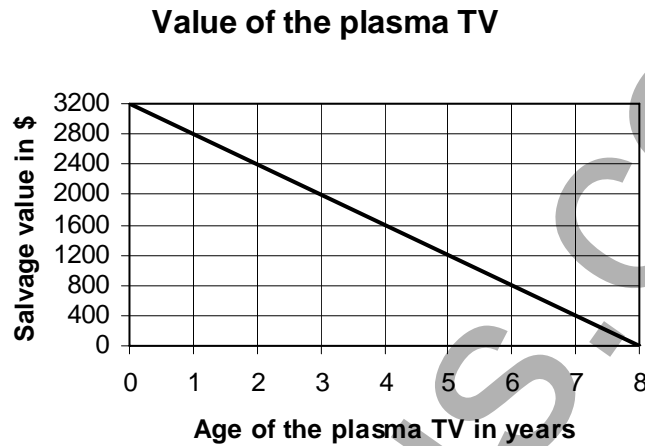
By how much per year does the value of the plasma television decrease?

    A $200
    B $400
    C $800
    D $3200

13 There are five runners in a race, numbered 1 to 5.
In how many ways can the five runners finish the race
(that is, in 1st place, 2nd place, 3rd place, 4th place and 5th place)?

    A   5
    B   120
    C   625
    D   3125

14 Solve $3x + 4 = 2x + 5$.

    A $x = -1$
    B $x = \dfrac{5}{9}$
    C $x = 1$
    D $x = \dfrac{9}{5}$

15 The time (*t*) taken to dig a ditch varies inversely with the number of workers (*w*) employed. Which formula correctly expresses *t* in terms of *w* and *k*, where *k* is a constant?

A $t = kw$

B $t = k + w$

C $t = \dfrac{k}{w}$

D $t = \dfrac{w}{k}$

16 This curve shows a normal distribution.
Which of the following statements is FALSE?
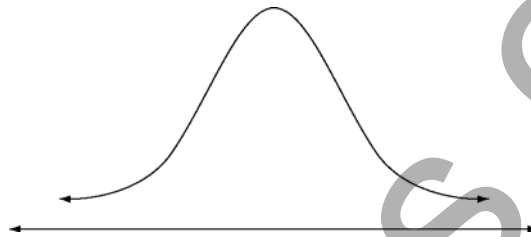
A The mean, median and mode lie on the line of symmetry.
B The number of scores above the mean is the same as the number below.
C Scores will most probably lie within two standard deviations from the mean.
D The distribution is skewed.

17 Which data set has a mean of 4, a median of 3 and a mode of 2?

A { 2, 2, 3, 2, 11 }
B { 2, 3, 2, 3, 3 }
C { 2, 2, 4, 2, 10 }
D { 2, 3, 7, 6, 2 }

18 The following pattern of shapes is built using matchsticks.
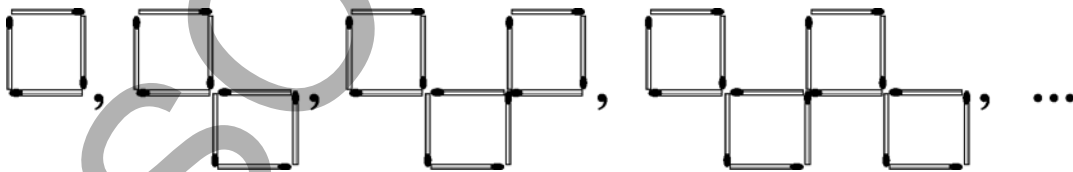
How many matchsticks would be needed to make the 50th shape?

A 50
B 150
C 200
D It cannot be counted

19   If $v = \dfrac{2gh}{m}$, which one of the following correctly expresses h as the subject?

A $h = \dfrac{mv}{2g}$

B $h = \dfrac{mgv}{2}$

C $h = 2mgv$

D $h = \dfrac{2g}{mv}$

20   Tiny Tim boards a plane in city A (40°N, 65°W) at 11:00 am local time. His next stop is city B (40°N, 30°W). What is the local time in city B when he boards his plane in city A?

A   8:40 am
B   11:00 am
C   1:20 pm
D   11:00 pm

21   The table shows the results for two classes of students in their language examinations.

Subject	Mean	Standard deviation
Chinese	50	10
French	55	7

What mark for Chinese is equivalent to a mark of 69 for French?

A   55
B   60
C   65
D   70

22 The results of Year 12 students in a Physics exam are displayed in a cumulative frequency histogram and polygon.

Physics marks
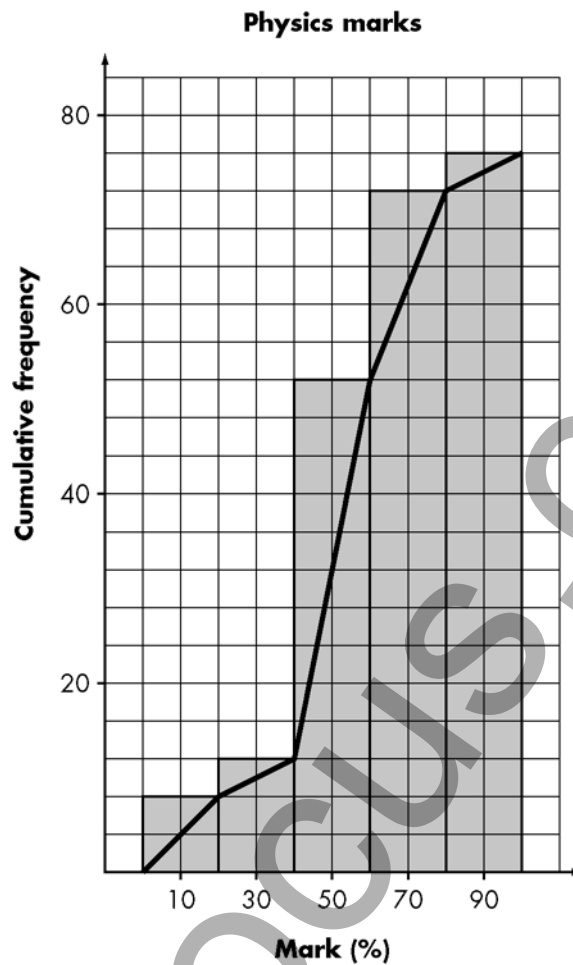
Estimate the median mark and the interquartile range of the Year 12 students.

A The median is 50 and the interquartile range is 21.
B The median is 53 and the interquartile range is 21.
C The median is 53 and the interquartile range is 27.
D The median is 50 and the interquartile range is 27.

End of Section I

Section II

78 marks
Attempt Questions 23–28
Allow about 2 hours for this section

Answer each question in the appropriate writing booklet. Extra writing booklets are available.

All necessary working should be shown in every question.

Marks

Question 23 (13 marks) Use the Question 23 Writing Booklet.

(a) The Northwealth Bank publishes the following loan repayment ready reckoner showing the monthly repayment amount for each $1000 borrowed.

| Interest rate | Term in years | | | | |
p.a.	5	10	15	20	25
5%	$18.87	$10.61	$7.91	$6.60	$5.85
6%	$19.33	$11.10	$8.44	$7.16	$6.44
7%	$19.80	$11.61	$8.99	$7.75	$7.07
8%	$20.28	$12.13	$9.56	$8.36	$7.72
9%	$20.76	$12.67	$10.14	$9.00	$8.39
10%	$21.25	$13.22	$10.75	$9.65	$9.09
11%	$21.74	$13.78	$11.37	$10.32	$9.80
12%	$22.24	$14.35	$12.00	$11.01	$10.53

Phuong borrows $320 000 to purchase a townhouse. The loan is to be repaid at 9% p.a. over 25 years.

  (i) Calculate Phuong's monthly repayment. **1**

  (ii) Find the total amount Phuong pays over the term of the loan. **1**

  (iii) How much extra per month would Phuong have had to pay if the loan was repaid over 15 years? **2**

  (iv) How much would Phuong have paid in total if the loan was repaid in 15 years? **1**

  (v) How much would Phuong have saved by paying the loan over 15 years rather than 25 years? **1**

Marks

Question 23 (continued)

(b)   The diagram shows a vertical cross-section of a river.
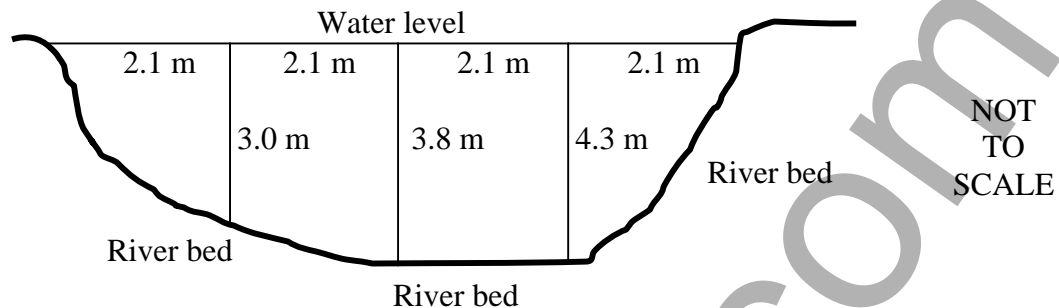
(i)   Use two applications of Simpson's rule to find the approximate
area of the river's cross-section.   **3**

(ii)   Estimate the volume of water, in cubic metres, in a 50 metre length
of this river, assuming the cross-section is the same as above and
uniform along the 50 metre length of the river.
Give your answer correct to the nearest cubic metre.   **2**

(c)   The dimensions of a rectangle, measured with a ruler graduated in
millimetres, are found to be 25 mm and 16 mm respectively.

Find the lower and upper limits between which the true area of the
rectangle lies.   **2**

End of Question 23

Marks

Question 24 (13 marks) Use the Question 24 Writing Booklet.

(a) The local cinema ran a horror and comedy movie promotion. Ten movies from each movie type were shown and the attendances for each showing were recorded as follows.

Horror	248	211	250	267	198	235	227	259	195	220
Comedy	199	213	208	325	211	200	215	203	196	210

    (i) Calculate the mean and standard deviation for each movie type. **2**

    (ii) Which movie type attracted a more consistent audience?
Give reasons for your answer. **1**

    (iii) Calculate the median for the comedy movies shown. **1**

    (iv) The cinema would like to run more comedy movies and therefore needs to plan for future audience numbers.
Should they base their planning on the mean or median?
Give reasons for your answer. **1**

    (v) The number of packets of lollies sold at each movie is normally distributed with a mean of 115 and a standard deviation of 17.
If 168 packets were sold during one movie would you consider this unusual? Give reasons for your answer. **2**

(b) In 2006 the NSW Department of Agriculture captured, tagged and released 6000 crayfish. In August 2007 a large number of crayfish were caught, and 15% were found to be recaptured tagged crayfish. Estimate the total population of crayfish in NSW in August 2007. **3**

(c) To assist with education costs for her daughter, Mrs Thrifty set up an annuity that would pay $6500 each year for 5 years of University expenses. Calculate the single amount that Mrs Thrifty must deposit at an interest rate of 8.7% p.a. to achieve this plan. **3**

End of Question 24

Marks

Question 25 (13 marks) Use the Question 25 Writing Booklet.

(a)   A boat sails 35 nautical miles west, then 45 nautical miles north.
        Calculate how far the boat is from its starting point,
        correct to the nearest nautical mile.   **2**

(b)   The diagram shows the results of a radial survey of a triangular area of land.

X 330°

054°

Y

NOT
TO
SCALE

35 m

22 m

O

243°   18 m

Z
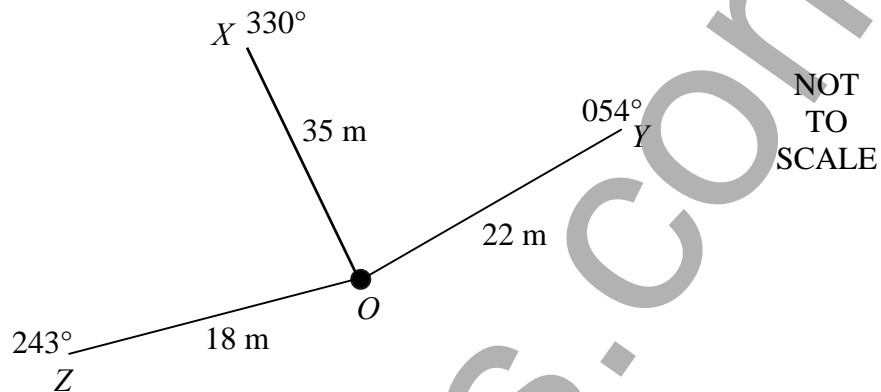
(i)   Find the size of angle *XOY*.   **1**

(ii)   Calculate the area of triangle *XOY*.   **2**

(c)   The menu at the local cafe includes the following items.

Burgers	**Fries**	**Drinks**
Plain	Small	Coke
Cheese	Large	Orange
Bacon		Lemonade
The Lot		

(i)   Draw a tree diagram to show all the possible menu choices.   **3**

(ii)   How many different combinations are there if a person must choose
        one item from each group?   **1**

(iii)   If, in each group, the person is equally likely to choose any one
        of the items, find the probability that the choice includes a bacon
        burger with large fries and an orange drink.   **1**

Question 25 continues on page 13

Question 25 (continued)

(d)   A particular medical test does not always give the correct results.
In fact, 15% of patients respond as negative to the test when they are infected,
while 40% of patients respond as negative to the test when they are truly
non-infected. It is known that 55% of the patients in the sample are infected.

(i)   Copy the table into your answer booklet and complete it for all
the missing values.   **2**

	Positive	Negative	
Infected			
Non-infected			
			100%

(ii)   In what percentage of cases is the test incorrect?   **1**

End of Question 25

Marks

Question 26 (13 marks) Use the Question 26 Writing Booklet.

(a) Professor Smart-Idea has a hypothesis that 'most people underestimate the length of a line'. A group of students decide to investigate this theory. They each estimate the lengths of several lines and then measure the actual lengths.

Length of line (cm)
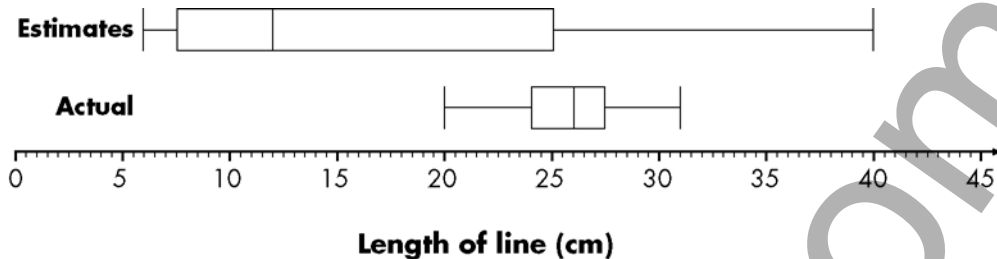
    (i)   Write down the median of the estimated lengths. **1**

    (ii)   Write down the median of the actual lengths. **1**

    (iii) What are the range and interquartile range for each data set? **2**

    (iv) Would you agree with the professor's hypothesis? Justify your answer. **2**

(b) During the 2006–2007 financial year, Mr Hickstone earned a gross income of $58 563. His tax instalments amounted to $14 691.42. However, Mr Hickstone earned a further gross income of $5416 on weekends. Since his expenses in earning the additional income were considerable, his allowable deductions amounted to $2804.

    (i)   Calculate Mr Hickstone's total gross income. **1**

    (ii)   Calculate Mr Hickstone's total taxable income. **1**

    (iii) Use the table to calculate the tax payable by Mr Hickstone. **2**

Taxable income ($)	Tax payable
$0–$10 000	Nil
$10 001–$28 000	Nil plus 25 cents for each $1 over $10 000
$28 001–$50 000	$4500 plus 30 cents for each $1 over $28 000
$50 001–$100 000	$11 100 plus 40 cents for each $1 over $50 000
over $100 000	$31 100 plus 60 cents for each $1 over $100 000

    (iv) Find the refund due or additional tax payable by Mr Hickstone. Clearly explain your answer. **1**

(c) New earthmoving machinery is bought for the local council and has an expected life of 15 years with a final scrap value of $175 000. If the purchase price was $1 850 000, what is the yearly depreciation? **2**

End of Question 26

Marks

Question 27 (13 marks) Use the Question 27 Writing Booklet.

(a)   The weight, W kg, of an object is inversely proportional to the square of its distance, d km, from the centre of the earth.

    (i)   Write the variation equation. **1**

    (ii)   On the Earth's surface, 6400 km from the Earth's centre, an astronaut weighs 60 kg. Calculate the weight of the astronaut in space 80 km above the Earth's surface. **3**

(b)   Mandy claims that a quick method for converting degrees Celsius to degrees Fahrenheit is to 'double and add 30'.

    (i)   Copy and complete the tables below to help you graph Mandy's rule and the actual conversion formula for values of C from 0 to 40. **5**

Mandy's rule: $F = 2C + 30$

C	0	10	20	30	40
F					

Actual conversion formula: $F = \dfrac{9}{5}C + 32$

C	0	10	20	30	40
F					

Now use the grid paper on page 22 to graph the above two tables.

    (ii)   For what value of C is Mandy's rule exactly equal to the actual conversion formula? **1**

    (iii)   For what values of C does Mandy's rule give answers that are too high? **1**

    (iv)   For what values of C is the difference between Mandy's rule and the actual conversion formula not more than 5° in Fahrenheit? **1**

    (v)   Is Mandy's quick method valid or not? Justify your answer. **1**

End of Question 27

Marks

Question 28 (13 marks) Use the Question 28 Writing Booklet.

(a) In the game of LINGO, numbers from 1 to 90 (inclusive) are randomly
     selected from a barrel and called out.
     Each player has a different card, similar to the following example.

8	14	24			51		75	
			34	49		63	79	90
		25	36		57	66		82

Players cross out the numbers as they are called out.
The winner is the first person to have a horizontal row of numbers
crossed out on their card.

(i)   What is the minimum number of calls needed before a game can
      be won?   **1**

(ii) What is the probability that the first number called out is one of the
      numbers on the top row of the card above?   **1**

(iii) What is the probability that the first two numbers called out are numbers
      on the top row of the card above?   **1**

(iv) Calculate the chance that a player with one lingo card has of winning
      in five calls.   **2**

(b) Reece is considering investing in shares. If he decides to invest, he has
     a 55% chance of making \$20 000 and a 45% chance of losing \$30 000.

(i)   Calculate the financial expectation involved in the investment Reece
      is considering.   **1**

(ii) Do you think Reece should invest in shares?
      Explain your answer.   **2**

Marks

Question 28 (continued)

(c)   A tent was made in the shape of a cone. The radius of the base of the tent is 2 m
and the height is 2.8 m.

Not to scale
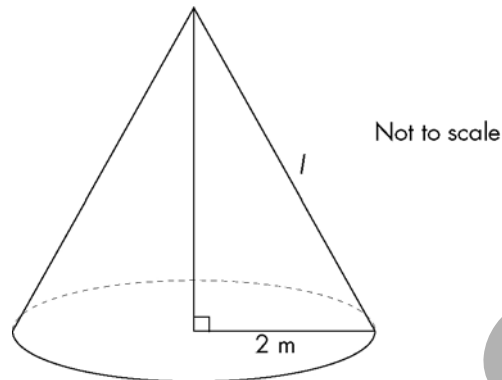
(i)   Draw a possible net of the tent.   **1**

(ii)   Calculate *l*, the slant height of the tent.   **1**

(iii)   The base of the tent was made from rubber sheeting.
What area of rubber sheeting was used to make the base of the tent?   **2**

(iv)   The curved surface of the tent is made from nylon.
Given that curved surface area $= \pi \times r \times l$, calculate the area
of the curved surface.   **1**

End of paper

This page has been intentionally left blank

General Mathematics – 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

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

$\theta =$ number of degrees in central angle

Arc length of a circle

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

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

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

$r =$ radius

$h =$ perpendicular height

Volume

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

Cylinder $\qquad V = \pi r^2 h$

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

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

$r =$ 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

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

Mean of a sample

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

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

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

Formula for a *z*-score

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

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:

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

Section I – Multiple Choice

Answer sheet

	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				

Use this grid paper to answer Question 27(b).
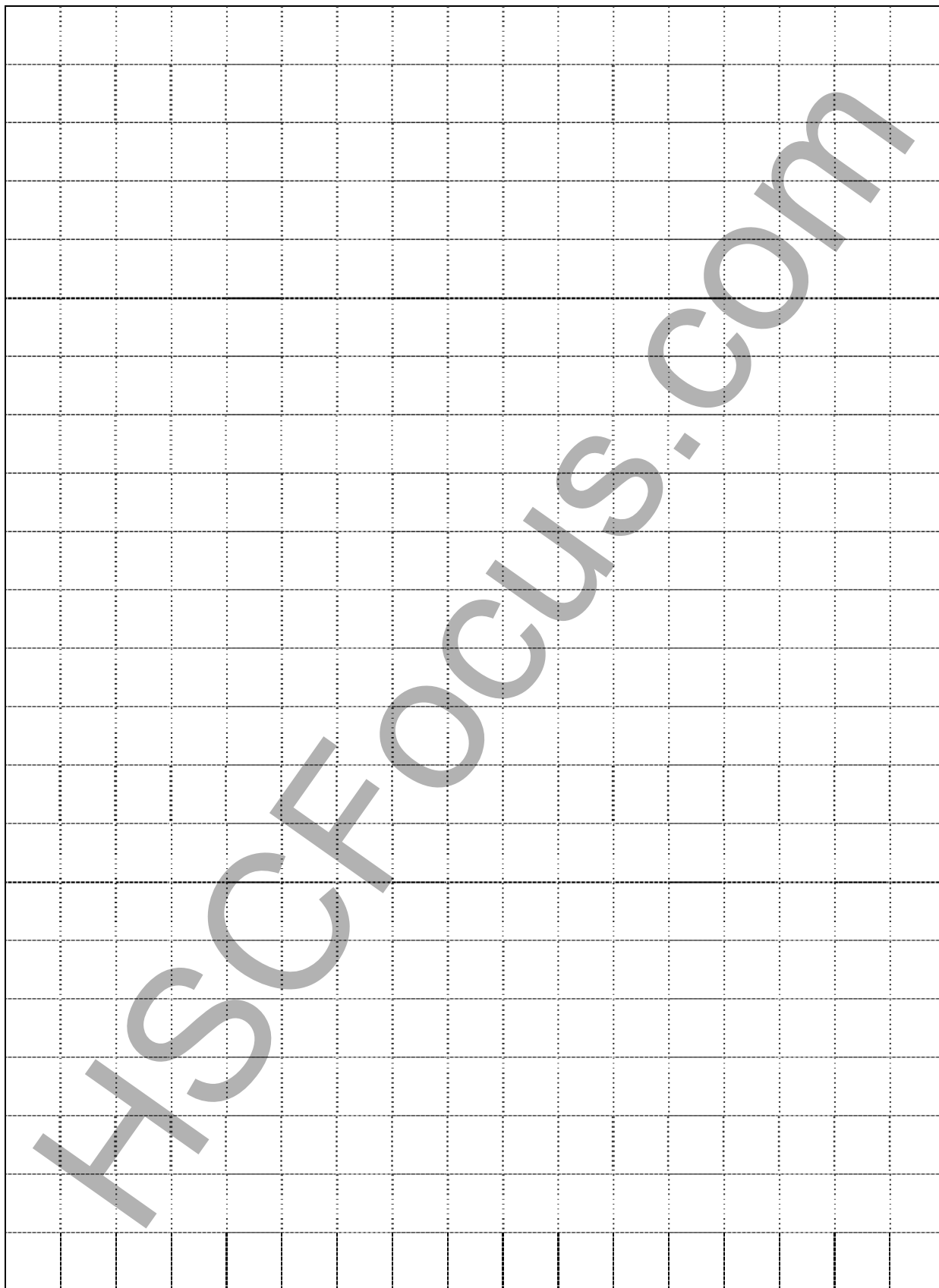
Mapping grid

Question	Mark	Content	Outcome	Strand
1	1	Scientific notation	P2, P7	M1
2	1	Correlation	H1, H2, H3, H4, H5	DA7
3	1	Annual leave loading	P1, P2, P8	FM1
4	1	Scale factor	P2, P6	M3
5	1	Commission	P1, P2, P8	FM1
6	1	Trigonometry	H1, H2, H6	M6
7	1	Area	H1, H2, H6	M5
8	1	GST	P2, P8, P11	FM3
9	1	Calculator skill	P2, P7	M1
10	1	Probability	P2, P4, P10, P11	PB2
11	1	Perimeter	P2, P3, P7	M1
12	1	Depreciation	H1, H2, H5, H8, H11	FM6
13	1	Arrangements	H2, H3, H4	PB3
14	1	Equation	P2, P3	AM1
15	1	Variation	H1, H2, H3, H5, H11	AM4
16	1	Normal distribution	H2, H5, H11	DA6
17	1	Summary statistics	P2, P7, P11	DA4
18	1	Algebraic pattern	P2, P3, P7	AM1
19	1	Changing the subject	H2, H3, H7, H11	AM3
20	1	Spherical geometry	H1, H2, H7, H11	M7
21	1	z-score	H2, H4, H5, H9, H11	DA6
22	1	Cumulative frequency	P2, P4, P7, P11	DA4
23(a)	6	Loan repayment	H1, H2, H5, H8, H11	FM5
23(b)	5	Simpson's rule	H1, H2, H3, H6, H7, H11	M5
23(c)	2	Error in measurement	P2, P5, P7	M1
24(a)	7	Summary statistics	P1, P2, P4, P7, P11	DA3, DA4
24(b)	3	Capture-recapture method	P1, P9, P11	DA2
24(c)	3	Annuities	H1, H2, H5, H8, H11	FM5
25(a)	2	Pythagoras' theorem	P2, P6, P7, P11	M4
25(b)	3	Trigonometry	H1, H2, H6, H7, H11	M6
25(c)	5	Probability	H2, H3, H4, H10, H11	PB3
25(d)	3	Two-way tables	H2, H4, H10, H11	PB4

Question	Mark	Content	Outcome	Strand
26(a)	6	Box plots	P1, P4, P7, P9, P11	DA3
26(b)	5	Taxation	P2, P7, P8, P11	FM3
26(c)	2	Depreciation	H1, H2, H5, H8, H11	FM6
27(a)	4	Variation	H1, H2, H3, H5, H11	AM4
27(b)	9	Modelling	H1, H2, H3, H5, H11	AM4
28(a)	5	Probability	H2, H3, H4, H10, H11	PB3
28(b)	3	Shares	H2, H4, H10, H11	PB4
28(c)	5	Perimeter and area	P2, P6, P7	M2

Marking guidelines

Section I

1	C	**12**	B
2	C	**13**	B
3	D	**14**	C
4	A	**15**	C
5	C	**16**	D
6	B	**17**	D
7	B	**18**	C
8	B	**19**	A
9	D	**20**	C
10	D	**21**	D
11	B	**22**	B

Section II

Question 23

Criteria	Marks
(a)(i) Monthly repayment $= \$320\,000 \div \$1000 \times \$8.39$ $= \$2684.80$	1
(ii) Total repaid $= \$2684.80 \times 12 \times 25$ $= \$805\,440$	1
(iii) Monthly repayment over 15 years $= \$320\,000 \div \$1000 \times \$10.14$ $= \$3244.80$	1
Hence extra paid per month $= \$3244.80 - \$2684.80$ $= \$560$	1
OR $(\$10.14 - \$8.39) \times 320 = \$560$ (2 marks for this method)	
(iv) Total repaid over 15 years $= \$3244.80 \times 12 \times 15$ $= \$584\,064$	1
(v) Saving $= \$805\,440 - \$584\,064$ $= \$221\,376$	1

Question 23 (continued)

Criteria	**Marks**
(b)(i) A $\approx \dfrac{2.1}{3}(0 + 4 \times 3 + 3.8) + \dfrac{2.1}{3}(3.8 + 4 \times 4.3 + 0)$ $= 0.7 \times 15.8 + 0.7 \times 21$ $= 11.06 + 14.7$ $= 25.76 \text{ m}^2$	2 1
(ii) V $= Ah$ $= 25.76 \times 50$ $= 1\,288 \text{ m}^3$	1 1
(c) ± 0.5 mm lower $24.5 \times 15.5 = 379.75 \text{ mm}^2$ upper $25.5 \times 16.5 = 420.75 \text{ mm}^2$	 1 1

Question 24

Criteria	**Marks**

(a)(i) Horror   mean = 231
               s.d. = 23.8
 	
       Comedy   mean = 218
                 s.d. = 36.2
	1
	
	 1

(ii) Horror movies, higher mean attendance and lower standard deviation.	1
(iii) 209.	1
(iv) Median, as the mean is affected/skewed by outlier score.	1
(v) mean = 115, s.d. = 17 Yes, unusual sale because 168 is more than 3 standard deviations above the mean.	2
(b) 15% of the population = 6000 1% of the population = 6000 ÷ 15 100% of the population = 6000 ÷ 15 × 100 = 40 000 Hence the estimated population of crayfish is 40 000.	1 1 1
(c) $A = M\left\{\dfrac{(1+r)^n - 1}{r(1+r)^n}\right\}$ Here, $M = \$6500$, $r = 0.087$, $n = 5$ $A = 6500\left\{\dfrac{(1+0.087)^5 - 1}{0.087(1+0.087)^5}\right\}$ $A = \$25\,480.77$	1 1 1

Question 25

Criteria	Marks
(a) $\quad d^2 = 35^2 + 45^2$ $\quad\quad d = \sqrt{1225 + 2025}$ $\quad\quad\quad = \sqrt{3250}$ The boat is 57 nautical miles from its starting point.	1 1
(b)(i) $\quad \angle XOY = (360° - 330°) + 54° = 84°$ (ii) $\quad$ Area $\Delta XOY \quad = \dfrac{1}{2}ab\sin C$ $\quad\quad\quad\quad\quad\quad = \dfrac{1}{2} \times 35 \text{ m} \times 22 \text{ m} \times \sin 84°$ $\quad\quad\quad\quad\quad\quad = 382.89 \text{ m}^2$ (correct to 2 dp)	1 1 1
(c)(i)	3 for diagram

Question 25 (continued)

Criteria	**Marks**
(c)(ii) 24	1
(iii) P(bacon burger with large fries and orange drink) = $\dfrac{1}{24}$	1

(d)(i)

	Positive	Negative	
Infected	40	15	55
Non-infected	5	40	45
	45	55	100%

Infected row	1
Non-infected row	1

(ii)   % testing incorrect = 15 + 5 = 20% | 1 |

Question 26

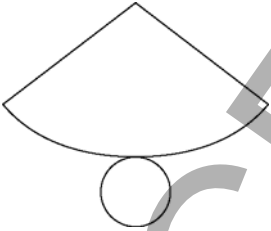| Criteria	Marks
(a)(i) Median of estimated lengths = 12 cm	1
(ii) Median of actual lengths = 26 cm	1
(iii) Estimates range = 40 – 6 = 34 cm IQR = 25 – 7.5 = 17.5 cm	1
Actual range = 31 – 20 = 11 cm IQR = 27.5 – 24 = 3.5 cm	1
(iv) Agree with the hypothesis, estimates have a much greater spread as well as a much lower median, even though some people did overestimate.	2
(b)(i) Gross income = \$58 563 + \$5416 = \$63 979	1
(ii) Taxable income = \$63 979 – \$2 804 = \$61 175	1

(iii)   Tax payable   = \$11 100 + (\$61 175 – \$50 000) × 0.40
                    = \$11 100 + \$11 175 × 0.40
                    = \$11 100 + \$4 470
                    = \$15 570
	1
	
	1

(iv) Tax paid = \$14 691.42 Tax that must be paid = \$15 570 Hence the tax to be paid by Mr Hickstone is \$878.58.	1
(c) $S = V_0 - Dn$ Here, $S = \$175\ 000$, $V_0 = \$1\ 850\ 000$ and $n = 15$ \$175 000 = \$1 850 000 – 15D 15D = \$1 850 000 – \$175 000 D = \$1 675 000 ÷ 15 D = \$111 666.67	1 1

Question 27

Criteria	Marks
(a)(i) $W = \dfrac{k}{d^2}$	1
(ii) $60 = \dfrac{k}{6400^2}$ $k = 2.4576 \times 10^9$	1
Hence, $W = \dfrac{2.4576 \times 10^9}{(6400+80)^2}$ $= 58.5$ kg (correct to 1 dp)	1 1
(b)(i) Mandy's rule: $\qquad\qquad F = 2C + 30$ <table><tr><td>**C**</td><td>0</td><td>10</td><td>20</td><td>30</td><td>40</td></tr><tr><td>**F**</td><td>**30**</td><td>**50**</td><td>**70**</td><td>**90**</td><td>**110**</td></tr></table> Actual conversion formula: $\qquad F = \dfrac{9}{5}C + 32$ <table><tr><td>**C**</td><td>0</td><td>10</td><td>20</td><td>30</td><td>40</td></tr><tr><td>**F**</td><td>**32**</td><td>**50**</td><td>**68**</td><td>**86**</td><td>**104**</td></tr></table> See next page for graph.	1 1 3
(ii) $C = 10$	1
(iii) Values of C that are above 10	1
(iv) Values of C that are 35 and below	1
(v) Yes, if the value is below 35	1

Question 27 (continued)
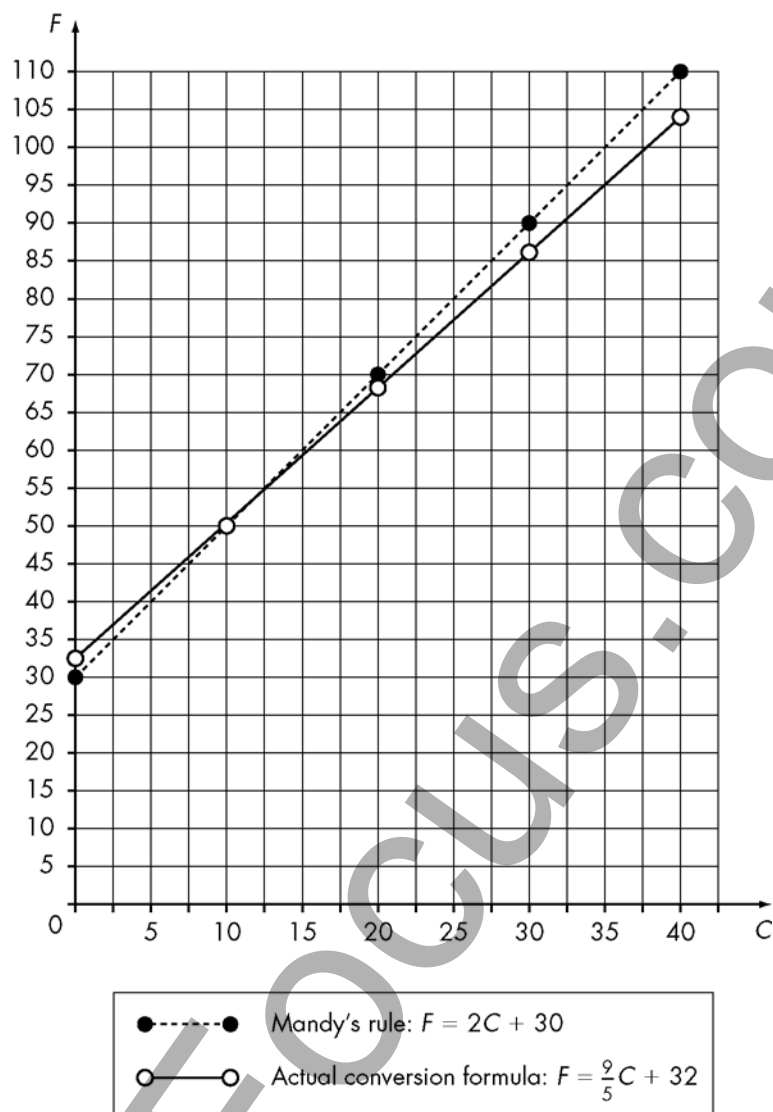
Question 28

Criteria	Marks
(a)(i) 5	1
(ii) P(first number is on top row) = $\dfrac{5}{90} = \dfrac{1}{18}$	1
(iii) P(first 2 numbers are on top row) = $\dfrac{5}{90} \times \dfrac{4}{89} = \dfrac{2}{801}$	1
(iv) P(chance of winning with 1 card) $= \dfrac{5! \times 3}{90 \times 89 \times 88 \times 87 \times 86}$ $= \dfrac{1}{146\,497\,560}$	1 1
(b)(i) Expected value $= \dfrac{55}{100} \times \$20\,000 - \dfrac{45}{100} \times \$30\,000$ $= -\$2\,500$	1
(ii) No, he is expected to make a loss of \$2500.	2
(c)(i)	1
(ii) $l^2 = 2.8^2 + 2^2$ $l = \sqrt{11.84}$ $l = 3.4$ m (correct to 1 dp)	1
(iii) $A = \pi r^2$ $A = \pi \times 2^2$ $A = 12.6$ m^2 (correct to 1 dp)	1
(iv) Curved surface area $= \pi \times r \times l$ $= \pi \times 2 \times 3.4$ $= 21.4$ m^2 (correct to 1 dp)	1