BOARD OF STUDIES
NEW SOUTH WALES

2010
HIGHER SCHOOL CERTIFICATE
EXAMINATION

General Mathematics

General Instructions
- Reading time – 5 minutes
- Working time – $2\frac{1}{2}$ hours
- Write using black or blue pen
- Calculators may be used
- A formulae sheet is provided at the back of this paper
- Write your Centre Number and Student Number on the Question 25 Writing Booklet

Total marks – 100

(Section I) Pages 2–12

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

(Section II) Pages 13–27

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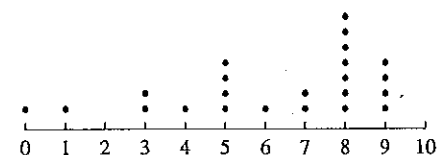- Allow about 2 hours for this section

3240

Section I

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

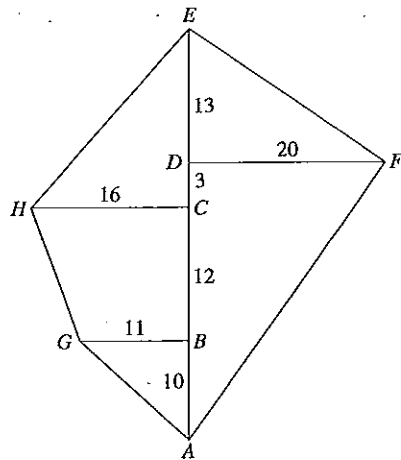Use the multiple-choice answer sheet for Questions 1–22.

1   The results of a survey are displayed in the dot plot.

What is the range of this data?

(A)   7

(B)   8

(C)   9

(D)   10

2   A new phone was purchased for $725 which included 10% GST.

What was the price of the phone without GST, correct to the nearest cent?

(A) $65.91

(B) $72.50

(C) $652.50

(D) $659.09

– 2 –

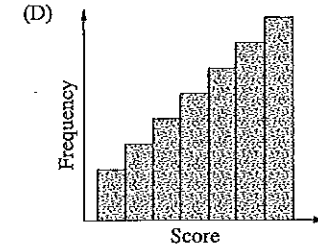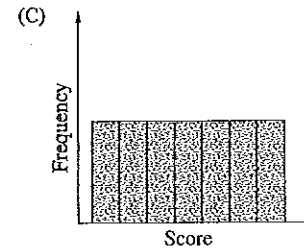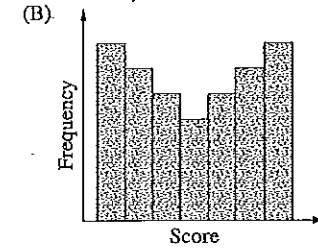**3** A field diagram has been drawn from an offset survey.

NOT TO
SCALE

All measurements
are in metres.

$AB = 10$ m
$BC = 12$ m
$CD = 3$ m
$DE = 13$ m

What is the distance from G to H, correct to the nearest metre?

(A) 11

(B) 13

(C) 16

(D) 20

4 Which of the following frequency histograms shows data that could be normally distributed?
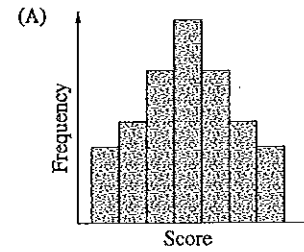
5 Minjy invests $2000 for 1 year and 5 months. The simple interest is calculated at a rate of 6% per annum.

What is the total value of the investment at the end of this period?

(A) $2170

(B) $2180

(C) $3003

(D) $3700

6   A survey of Year 7 students found a number of relationships with a high degree of correlation.

Which of the following relationships also demonstrates causality?

(A)   Students' height and the length of their arm span

(B)   The size of students' left feet and the size of their right feet

(C)   Students' test scores in Mathematics and their test scores in Music

(D)   The number of hours students spent studying for a test and their results in that test

7   If $M = -9$, what is the value of $\dfrac{3M^2 + 5M}{6}$?

(A)   −250.5

(B)   −48

(C)   33

(D)   235.5

8   A bag contains red, green, yellow and blue balls.

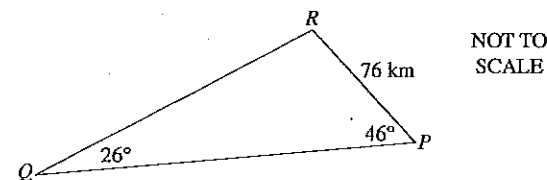| Colour	Probability
Red	$\dfrac{1}{3}$
Green	$\dfrac{1}{4}$
Yellow	?
Blue	$\dfrac{1}{6}$

The table shows the probability of choosing a red, green or blue ball from the bag.

If there are 12 yellow balls in the bag, how many balls are in the bag altogether?

(A)   16

(B)   36

(C)   48

(D)   60

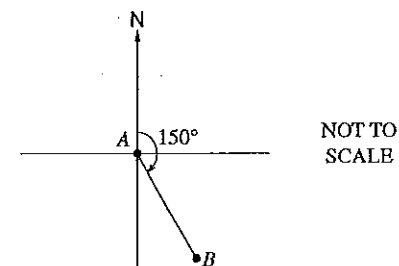9   Three towns P, Q and R are marked on the diagram.

The distance from R to P is 76 km. $\angle RQP = 26°$ and $\angle RPQ = 46°$.

What is the distance from P to Q to the nearest kilometre?

(A)   100 km
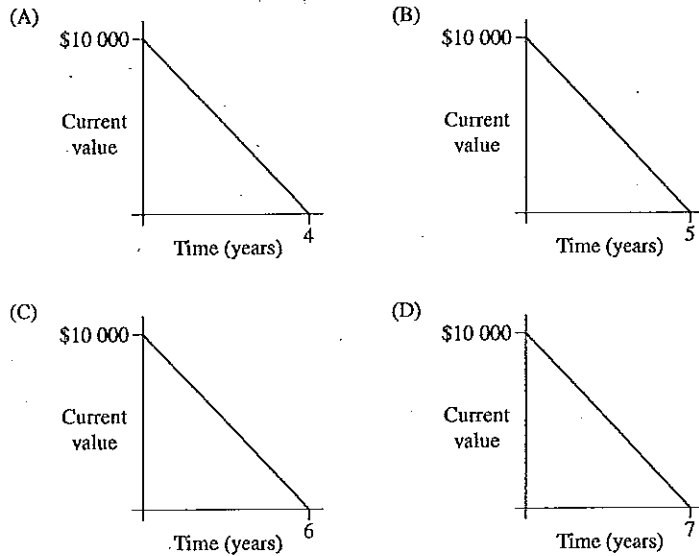
(B)   125 km

(C)   165 km

(D)   182 km

10   A plane flies on a bearing of 150° from A to B.

What is the bearing of A from B?

(A)   30°

(B)   150°

(C)   210°

(D)   330°

11 Which of the following graphs shows the lowest rate of depreciation over the given time period?

(A)

$10 000
Current value
Time (years) 4

(B)

$10 000
Current value
Time (years) 5

(C)

$10 000
Current value
Time (years) 6

(D)

$10 000
Current value
Time (years) 7

12 A group of 347 people was tested for flu and the results were recorded. The flu test results are not always accurate.
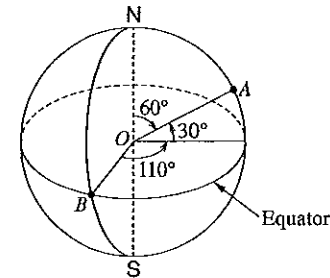
Test results

	Test indicated flu	Test did not indicate flu	Total
People with flu	72	3	75
People without flu	16	256	272
	88	259	347

A person is selected at random from the tested group.

What is the probability that their test result is accurate, to the nearest per cent?

(A) 21%

(B) 22%

(C) 95%

(D) 96%

13 The number of hours that it takes for a block of ice to melt varies inversely with the temperature. At 30°C it takes 8 hours for a block of ice to melt.

How long will it take the same size block of ice to melt at 12°C?

(A) 3.2 hours

(B) 20 hours

(C) 26 hours

(D) 45 hours

14 A restaurant serves three scoops of different flavoured ice-cream in a bowl. There are five flavours to choose from.

How many different combinations of ice-cream could be chosen?

(A) 10

(B) 15

(C) 30

(D) 60

15 In this diagram of the Earth, O represents the centre and B lies on both the Equator and the Greenwich Meridian.

NOT TO SCALE

What is the latitude and longitude of point A?

(A) 30°N 110°E

(B) 30°N 110°W

(C) 60°N 110°E

(D) 60°N 110°W

16　This back-to-back stem-and-leaf plot displays the test results for a class of 26 students.

| Boys		Girls				
1	2	1	2	4		
3	3	0	2	3	5	
9　7　4	4	4	4	5	9	9
6　4　2　2	5	3				
3　0	6	1	9			

What is the median test result for the class?

(A)　44

(B)　46

(C)　48

(D)　49

17　During a flood 1.5 hectares of land was covered by water to a depth of 17 cm.

How many kilolitres of water covered the land? (1 hectare $= 10\ 000\ \text{m}^2$)

(A)　2.55 kL

(B)　2 550 kL

(C)　255 000 kL

(D)　2 550 000 kL

18　Which of the following correctly expresses x as the subject of $a = \dfrac{nx}{5}$?

(A)　$x = \dfrac{an}{5}$

(B)　$x = \dfrac{5a}{n}$

(C)　$x = \dfrac{a-5}{n}$

(D)　$x = 5a - n$

19　The diagram shows half an ellipse with a rectangle cut out.

NOT TO SCALE

All measurements are in centimetres.
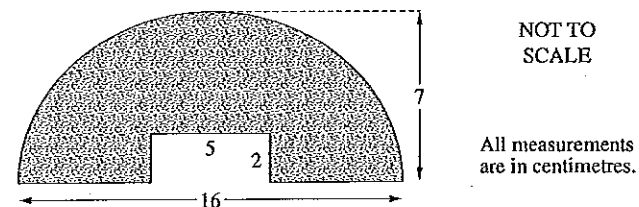
What is the area of the shape to the nearest square centimetre?

(A)　78 cm^2

(B)　83 cm^2

(C)　166 cm^2

(D)　171 cm^2

20　Lou and Ali are on a fitness program for one month. The probability that Lou will finish the program successfully is 0.7 while the probability that Ali will finish successfully is 0.6. The probability tree shows this information.
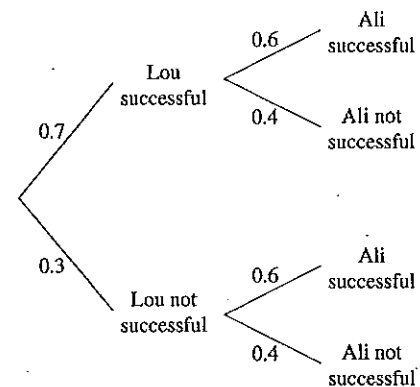
What is the probability that only one of them will be successful?

(A)　0.18

(B)　0.28

(C)　0.42

(D)　0.46

21 The area graph shows the costs and profits for a business over a period of time.

Costs

Profit

Months

The information in the area graph is then displayed as a line graph.
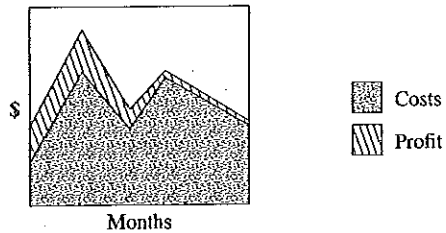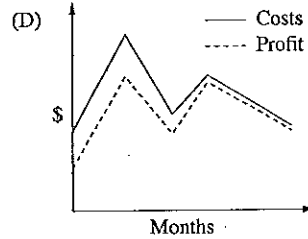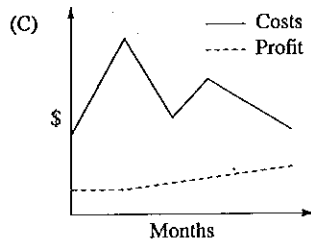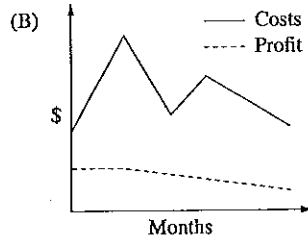
Which of the following line graphs best displays the data from the area graph?

(A)

—— Costs
---- Profit

$

Months

(B)

—— Costs
---- Profit

$

Months

(C)

—— Costs
---- Profit

$

Months

(D)

—— Costs
---- Profit

$

Months
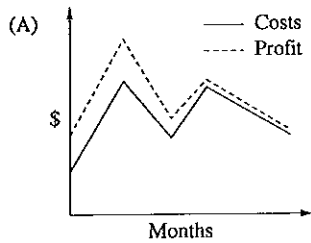
22 In July, Ms Alott received a statement for her credit card account. The account has no interest free period. Simple interest is calculated and charged to her account on the statement date.

Ms I O Alott   Dollar Bank

Credit limit: $5000   Credit card statement

Statement date: 23 July 2010

Previous Balance	Payments	Purchases	Interest charged
$529.46	$529.46	$1721.50	?

Date	Purchases	Amount	Closing Balance
29 June	HI-FI	$1721.50	?

Annual percentage rate: 19%

Daily percentage rate: 0.0521%

Note: Interest is charged on amounts from (and including) the date of purchase up to (and including) the statement date.

Minimum payment due: $25 or 5% of closing balance whichever is the larger.

What is the minimum payment due on this account?

(A) $22.42

(B) $25.00

(C) $86.08

(D) $87.20

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.

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

(a)   This advertisement appeared in a newspaper.   2

Civil Engineer

Base rate of pay: $1586.70 per week.

Depending upon qualifications and experience, up to an additional 3.5% may be added to the weekly base rate of pay.

What is the maximum possible salary per annum for this civil engineer, correct to the nearest dollar?

(b)   The elevation and floor plan of a building are shown.
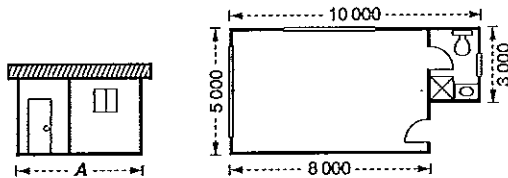
All measurements are in millimetres.

(i)   What does this symbol ⊠ represent on the plan?   1

(ii)   What is the value of **A** on the elevation?   1

(iii) Calculate the area of the floor of this building in square metres.   2

Question 23 (continued)

(c)   On Saturday, Jonty recorded the colour of T-shirts worn by the people at his gym. The results are shown in the graph.

T-shirt colours at the gym
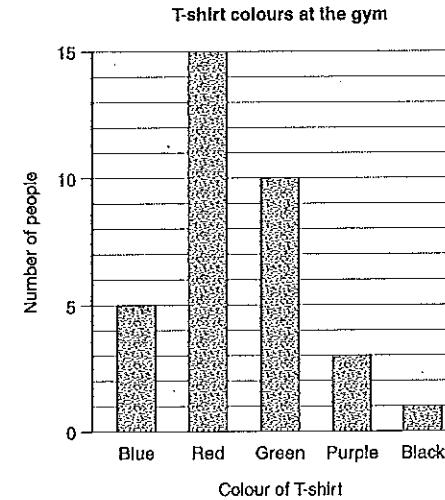
(i)   How many people were at the gym on Saturday? (Assume everyone was wearing a T-shirt.)   1

(ii)   What is the probability that a person selected at random at the gym on Saturday, would be wearing either a blue or green T-shirt?   1

Question 23 (continued)

(d) Warrick has a net income of $590 per week. He has created a budget to help manage his money.

	A	B	C
1	Warrick's Weekly Budget		
2			
3	Rent	$175	
4	Petrol	$45	
5	Car registration	$10	
6	Car maintenance	$15	
7	Food	$90	
8	Electricity	X	
9	Telephone and Internet	$40	
10	Insurances	$30	
11	Entertainment	$70	
12	Clothes and gifts	$50	
13	Savings	$40	
14	Total	$590	

Sheet 1 / Sheet 2 /

(i) Find the value of X, the amount that Warrick allocates towards electricity each week.   1

(ii) Warrick has an unexpectedly high telephone and internet bill. For the last three weeks, he has put aside his savings as well as his telephone and internet money to pay the bill.   1

How much money has he put aside altogether to pay the bill?

(iii) The bill for the telephone and internet is $620. It is due in two weeks time. Warrick realises he has not put aside enough money to pay the bill.   3

How could Warrick reallocate non-essential funds in his budget so he has enough money to pay the bill? Justify your answer with suitable reasons and calculations.

End of Question 23

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

(a) Fred tried to solve this equation and made a mistake in Line 2.

$$4(y+2)-3(y+1)=-3 \qquad \text{Line 1}$$
$$4y+8-3y+3=-3 \qquad \text{Line 2}$$
$$y+11=-3 \qquad \text{Line 3}$$
$$y=-14 \qquad \text{Line 4}$$

Copy the equation in Line 1 into your writing booklet.

(i) Rewrite Line 2 correcting his mistake.   1

(ii) Continue your solution showing the correct working for Lines 3 and 4 to solve this equation for y.   1

(b) Ashley makes picture frames as part of her business. To calculate the cost, C, in dollars, of making x frames, she uses the equation   2

$$C = 40 + 10x.$$

She sells the frames for $20 each and determines her income, I, in dollars, using the equation

$$I = 20x.$$

Planned Income and costs for Ashley's business
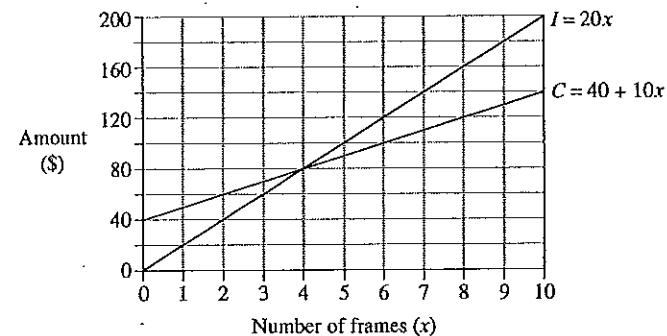
Use the graph to solve the two equations simultaneously for x and explain the significance of this solution for Ashley's business.

Question 24 (continued)

(c)   The marks in a class test are normally distributed. The mean is 100 and the standard deviation is 10.

    (i)   Jason's mark is 115. What is his z-score?   **1**

    (ii) Mary has a z-score of 0. What mark did she achieve in the test?   **1**

    (iii) What percentage of marks lie between 80 and 110?   **2**

    You may assume the following:
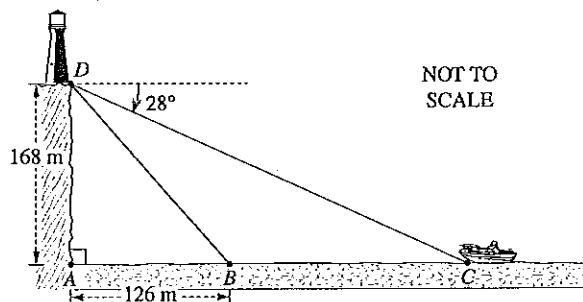
- 68% of marks have z-scores between −1 and 1
- 95% of marks have z-scores between −2 and 2
- 99.7% of marks have z-scores between −3 and 3.

(d)   The base of a lighthouse, D, is at the top of a cliff 168 metres above sea level. The angle of depression from D to a boat at C is 28°. The boat heads towards the base of the cliff, A, and stops at B. The distance AB is 126 metres.

NOT TO SCALE

    (i)   What is the angle of depression from D to B, correct to the nearest minute?   **3**

    (ii) How far did the boat travel from C to B, correct to the nearest metre?   **2**

End of Question 24

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

(a)   Rainfall data has been collected at nine locations across NSW. This data is displayed in the scatterplot on page 1 of the Question 25 Writing Booklet.

    (i)   On the scatterplot circle the median points and hence construct a median regression line.   **2**

    (ii) Use this model to predict the average annual rainfall in a location that has 120 days on which rain falls.   **1**

(b)   William wants to buy a car. He takes out a loan for $28 000 at 7% per annum interest for four years.   **2**

Monthly repayments for loans at different interest rates are shown in the spreadsheet.

	A	B	C	D	E
1		Monthly repayments			
2		Term of loan (in months)	48		
3					
4	Amount	Interest rate p.a.			
5	borrowed	6%	7%	8%	9%
6	$27 000	$634.10	$646.55	$659.15	$671.90
7	$27 500	$645.84	$658.52	$671.36	$684.34
8	$28 000	$657.58	$670.49	$683.56	$696.78
9	$28 500	$669.32	$682.47	$695.77	$709.22
10	$29 000	$681.07	$694.44	$707.97	$721.67
11	$29 500	$692.81	$706.41	$720.18	$734.11
12	$30 000	$704.55	$718.39	$732.39	$746.55

Sheet 1 / Sheet 2

How much interest does William pay over the term of this loan?

Question 25 (continued)

(c) Lee is going on a cruise ship holiday.

    (i) The ship leaves Port Ary (15°S, 167°E) and sails north to Nauru   **2**
       (1°S, 167°E) at an average speed of 15 knots.

       How long does the journey take? (You may assume that 1° on a great
       circle equals 60 nautical miles.)

    (ii) Lee wants to call home to Sydney (34°S, 151°E) from Papeete,   **2**
       Tahiti (17°S, 149°W) when it is 7 pm on Friday in Sydney.

       Give the time and day in Papeete when she should make the call.
       (Ignore time zones.)

(d) Mark needs $8000 to go on a holiday in three years time. He has a 'Holiday   **4**
    Savings Account' with a balance of $600.

    He arranges to deposit $150 into this account at the end of each month for the
    next three years.

    He earns 6% per annum interest on the money in his account, compounded
    monthly.

    Will Mark have enough money for his trip at the end of three years? Justify your
    answer with suitable calculations.

End of Question 25

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

(a) A design of numberplates has a two-digit number, two letters and then another
    two-digit number, for example | 22 AC 14 | or | 76 BB 08 |.

    (i) How many different numberplates are possible using this design?   **1**

    (ii) Jo's birthday is 30 December 1992, so she would like a numberplate with   **2**

       either | 30 JO 12 | or | 19 JO 92 |.

       Jo can order a numberplate with 'JO' in the middle but will have to have
       randomly selected numbers on either side.

       What is the probability that Jo is issued with one of the numberplates she
       would like?

(b) A new shopping centre has opened near a primary school. A survey is conducted
    to determine the number of motor vehicles that pass the school each afternoon
    between 2.30 pm and 4.00 pm.

    The results for 60 days have been recorded in the table and are displayed in the
    cumulative frequency histogram.

Score	Class centre	Frequency	Cumulative frequency
100–124	112	10	10
125–149	137	×	25
150–174	162	20	45
175–199	187	15	60
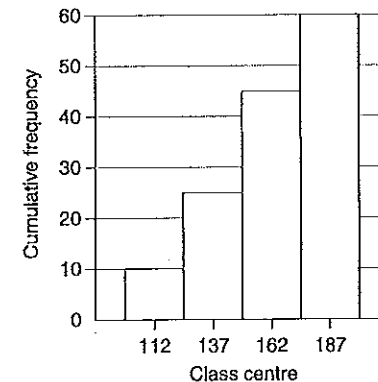
Question 26 continues on page 21

Question 26 (continued)

(i) Find the value of X in the table.   **1**

(ii) Carefully copy the cumulative frequency histogram into your writing booklet.   **1**

On the cumulative frequency histogram you have copied draw a cumulative frequency polygon (ogive) for this data.

(iii) Use your graph to determine the median. Show, by drawing lines on your graph, how you arrived at your answer.   **1**

(iv) Prior to the opening of the new shopping centre, the median number of motor vehicles passing the school between 2.30 pm and 4.00 pm was 57 vehicles per day.   **2**

What problem could arise from the change in the median number of motor vehicles passing the school before and after the opening of the new shopping centre?

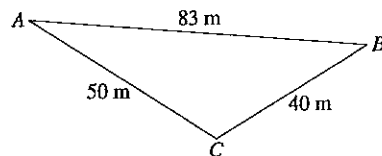Briefly recommend a solution to this problem.

(c) Tai plays a game of chance with the following outcomes.   **2**

- $\frac{1}{5}$ chance of winning $10

- $\frac{1}{2}$ chance of winning $3

- $\frac{3}{10}$ chance of losing $8

The game has a $2 entry fee.

What is his financial expectation from this game?
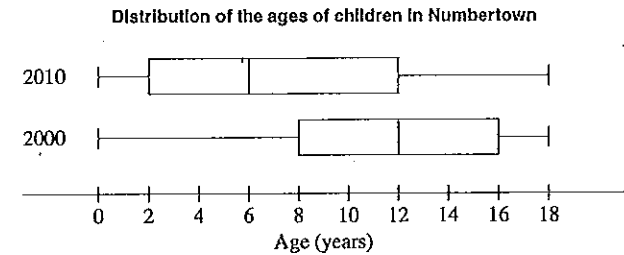
(d)   **3**

NOT TO SCALE

Find the area of triangle ABC, correct to the nearest square metre.

End of Question 26

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

(a) Fully simplify $\dfrac{4x^2}{3y} \div \dfrac{xy}{5}$.   **3**

(b) The graphs show the distribution of the ages of children in Numbertown in 2000 and 2010.

Distribution of the ages of children in Numbertown

(i) In 2000 there were 1750 children aged 0–18 years.   **1**

How many children were aged 12–18 years in 2000?

(ii) The number of children aged 12–18 years is the same in both 2000 and 2010.   **1**

How many children aged 0–18 years are there in 2010?

(iii) Identify TWO changes in the distribution of ages between 2000 and 2010. In your answer, refer to measures of location or spread or the shape of the distributions.   **2**

(iv) What would be ONE possible implication for government planning, as a consequence of this change in the distribution of ages?   **1**

Question 27 (continued)

(c) The graph shows tax payable against taxable income, in thousands of dollars.

Tax payable (thousands of dollars) vs Taxable income (thousands of dollars)
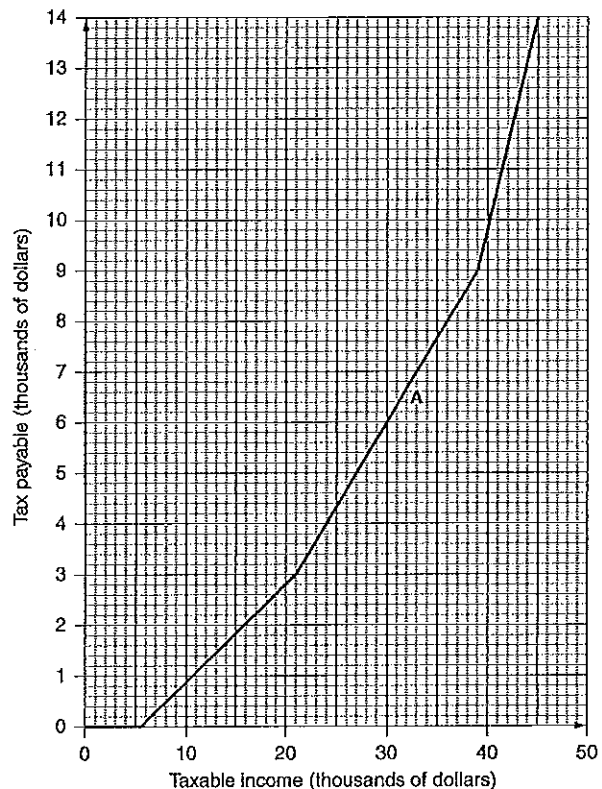
(i) Use the graph to find the tax payable on a taxable income of $21 000.   1

(ii) Use suitable points from the graph to show that the gradient of the section of the graph marked **A** is $\frac{1}{3}$.   1

(iii) How much of each dollar earned between $21 000 and $39 000 is payable in tax?   1

(iv) Write an equation that could be used to calculate the tax payable, T, in terms of the taxable income, I, for taxable incomes between $21 000 and $39 000.   2

End of Question 27

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

(a) The table shows monthly home loan repayments with interest rate changes from February to October 2009.

Monthly home loan repayments

	A	B	C	D	E
1					
2	Dates	Feb 2009	Apr 2009	Jun 2009	Oct 2009
3	Increase/Decrease	−1.0%	−0.1%	0.05%	0.25%
4	Rate	5.85%	5.75%	5.80%	6.05%
5	$1 000	$6.35	$6.29	$6.32	$6.47
6	$50 000	$318	$315	$316	$324
7	$100 000	$635	$629	$632	$647
8	$150 000	$953	$944	$948	$971
9	$200 000	$1 270	$1 258	$1 264	$1 295
10	$250 000	$1 588	$1 573	$1 580	$1 618
11	$300 000	$1 905	$1 887	$1 896	$1 942
12	$350 000	$2 223	$2 202	$2 212	$2 266
13	$400 000	$2 541	$2 516	$2 529	$2 589
14					

Sheet 1 / Sheet 2

(i) What is the change in monthly repayments on a $250 000 loan from February 2009 to April 2009?   1

(ii) Xiang wants to borrow $307 000 to buy a house.   3

Xiang's bank approves loans for customers if their loan repayments are no more than 30% of their monthly gross salary.
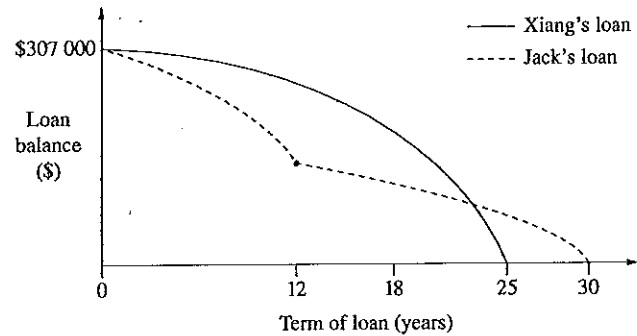
Xiang's monthly gross salary is $6 500.

If she had applied for the loan in October 2009, would her bank have approved her loan?

Justify your answer with suitable calculations.

Question 28 continues on page 25

(iii) Jack took out a loan at the same time and for the same amount as Xiang. **2**
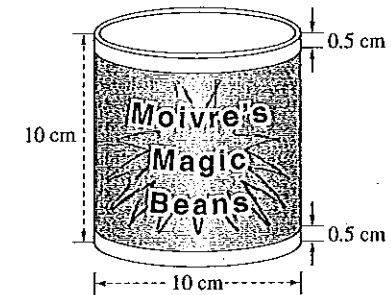Graphs of their loan balances are shown.

Identify TWO differences between the graphs and provide a possible
explanation for each difference, making reference to interest rates and/or
loan repayments.

(b) Moivre's manufacturing company produces cans of Magic Beans. The can has
a diameter of 10 cm and a height of 10 cm.

(i) Cans are packed in boxes that are rectangular prisms with dimensions **1**
30 cm × 40 cm × 60 cm.

What is the maximum number of cans that can be packed into one of
these boxes?

(ii) The shaded label on the can shown wraps all the way around the can with **2**
no overlap.

What area of paper is needed to make the labels for all the cans in this
box when the box is full?

(iii) The company is considering producing larger cans. Monica says if you **2**
double the diameter of the can this will double the volume. Is Monica
correct? Justify your answer with suitable calculations.

Question 28 (continued)

(iv) The company wants to produce a can with a volume of 1570 cm³, using   2
the least amount of metal. Monica is given the job of determining the
dimensions of the can to be produced. She considers the following
graphs.

Surface area of a can
with a volume of 1570 cm³

Dimensions of a can
with a volume of 1570 cm³
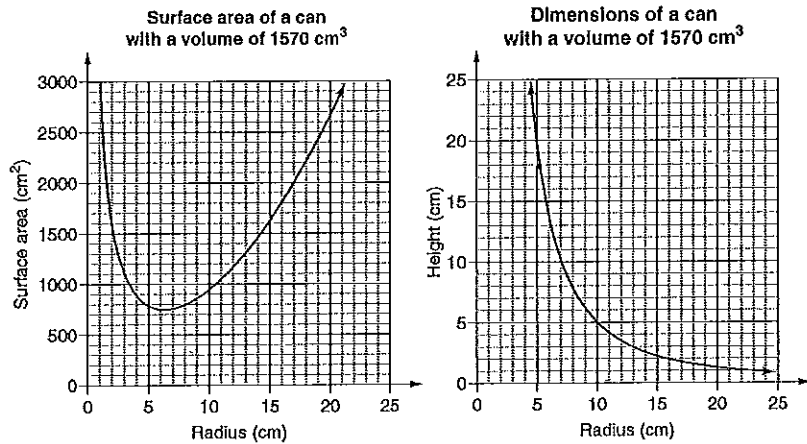
What radius and height should Monica recommend that the company use
to minimise the amount of metal required to produce these cans? Justify
your choice of dimensions with reference to the graphs and/or suitable
calculations.

End of paper

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General Mathematics

FORMULAE SHEET

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

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 $\quad V = \pi r^2 h$

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

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

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

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

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

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

Present value (N) of an annuity

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

or

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

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

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

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

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

Formula for a z-score

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

s = standard deviation

Gradient of a straight line

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

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:

$P(\text{event}) = \dfrac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$
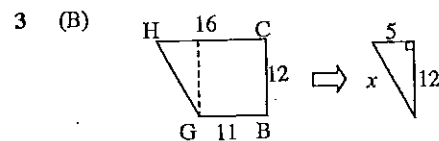
<div style="text-align:center; border:1px solid">

2010 Higher School Certificate
Solutions
General Mathematics

</div>

SECTION I
Summary

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

1 (C) Range = highest score − lowest score
$$= 9 - 0$$
$$= 9.$$

2 (D) 110% of pre - GST price = $725
1% of pre - GST price = $725 ÷ 110
$$= \$6 \cdot 5909...$$
100% of pre - GST price = $6 \cdot 590 \times 100$
$$= \$659 \cdot 09.$$

3 (B)

H ——16—— C   5
G 11 B   x 12 12

$$GH^2 = 5^2 + 12^2$$
$$= 25 + 144$$
$$= 169.$$
$$GH = \sqrt{169}$$
$$= 13 \ m.$$

4 (A) This is the closest match to resemble a bell shape.

5 (A)
$$Interest = 2000 \times 0 \cdot 06 \times \frac{17}{12}$$
$$= \$170$$
$$Total\ value = 2000 + 170$$
$$= \$2170$$
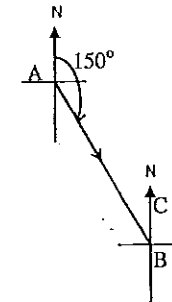
6 (D) Hours spent studying causes test results.

7 (C)
$$\frac{3M^2 + 5M}{6} = \frac{3(-9)^2 + 5(-9)}{6}$$
$$= 33$$

8 (C)
$$P(Yellow) = 1 - \frac{1}{3} - \frac{1}{4} - \frac{1}{6} = \frac{1}{4}$$
If the yellow balls represent $\frac{1}{4}$, then the total number of balls = 12 x 4 = 48

9 (C) $\angle PRQ = 180° - 26° - 46° = 108°$
By sine rule,
$$\frac{PQ}{\sin 108°} = \frac{76}{\sin 26°}$$
$$PQ = \frac{76 \sin 108°}{\sin 26°}$$
$$PQ = 164.8837...$$
$$PQ = 165\ km$$

10 (D)

N
A ⌒150°
N
C
B

$$\angle ABC = 180° - 150° = 30°$$
Bearing of A from B $= 360° - 30°$
$$= 330°$$

11 (D) Of the 4 graphs, D, takes the longest time 7 years, for $10 000 to depreciate to $0.

12 (C) Test result is accurate when people with flu are tested positive (72), and people without flu are tested negative (256).
Total in tested group = 347.
Total accurate results = 72 + 256
$$= 328$$
$$P(accurate) = \frac{328}{347} \times 100$$
$$= 94.52...$$
$$= 95\%$$

13 (B) $H = \frac{k}{T}$ where H is hours
and T is tempature (°C)
When T = 30, H = 8
$$8 = \frac{k}{30} \quad \Rightarrow k = 240$$
$$\therefore H = \frac{240}{T}$$
When T = 12
$$H = \frac{240}{12}$$
$$H = 20$$

14 (A) Possible combinations $= \frac{5 \times 4 \times 3}{3 \times 2 \times 1}$
$$= 10$$

15 (A) A is 110°E of the Greenwich Meridian and 30°N of the equator.

16 (B) There are 26 scores when the boys are combined with the girls' scores. Middle score is the average of the thirteenth and the fourteenth scores, 45 and 47.
Median $= \frac{45 + 47}{2}$
$$= 46$$

17 (B) 1 hectare = 10 000 m²
$\therefore 1.5$ hectares = 15 000 m²
and 17 cm = 0.17 m
$$V = A \times h$$
$$= 15 000 \times 0.17$$
$$= 2 550\ m^3$$
$$= 2 550\ kL \ (as\ 1\ m^3 = 1kL)$$

18 (B)
$$a = \frac{nx}{5}$$
$$5a = nx$$
$$\frac{5a}{n} = x$$
$$x = \frac{5a}{n}$$

19 (A) $A_{half\ ellipse} = \pi ab \div 2$
$$= \pi \times 8 \times 7 \div 2$$
$$= 28\pi$$
$$= 88\ m^2$$
$A_{rectangle} = 5 \times 2$
$$= 10\ m^2$$
$A_{shape} = A_{half\ ellipse} - A_{rectangle}$
$$= 88 - 10$$
$$= 78\ m^2$$

20 (D) P(1 successful) = P(Lou yes, Ali no) + P(Ali yes, Lou no)
$$= 0.7 \times 0.4 + 0.3 \times 0.6$$
$$= 0.28 + 0.18$$
$$= 0.46$$

21 (B) The difference between the profits and costs sections in the area graph is initially constant then steadily decreases. Therefore, the actual profit graph should start flat and then decrease over time (as the differences become smaller).

22 (D) Number of days = $2 + 23 = 25$ days

Interest $= \$1721.50 \times 0.000521 \times 25$
$= \$22.42$

Closing balance $= \$1721.50 + \$22.42$
$= \$1743.92$

5% of balance $= 0.05 \times 1743.92$
$= \$87.20$

SECTION II

Question 23

(a)
$$\text{Max. weekly} = 1586.70 + 1586.70 \times \frac{3.5}{100}$$
$$= \$1642.23$$
$$\text{Max. annual} = \$1642.23 \times 52$$
$$= \$85\,396$$

(b) (i) Shower area

(ii) $A = 5000\text{ mm}$
(Elevation is right view of floor plan)

(iii) Main floor $= 8000\text{ mm} \times 5000\text{ mm}$
$= 8\text{ m} \times 5\text{ m}$
$= 40\text{ m}^2$

Width bathroom $= 10000 - 8000$
$= 2000\text{ mm}$

Area bathroom $= 2000 \times 3000$
$= 2\text{ m} \times 3\text{ m}$
$= 6\text{ m}^2$

Total area $= 40 + 6 = 46\text{ m}^2$

(c) (i) Number of people $= 5 + 15 + 10 + 3 + 1$
$= 34$

(ii) $\text{P (Blue or Green)} = \dfrac{5+10}{34} = \dfrac{15}{34}$

(d) (i) Expenses $= 75 + 45 + 10 + 15 + 90$
$+ 40 + 30 + 70 + 50 + 40$
$= \$565$

Electricity $= \$590 - \$565$
$= \$25$

(ii) Money put aside $= (\$40 + \$40) \times 3$
$= \$240$

(iii) Warrick still needs $= \$620 - \$240$
$= \$380.$

He needs to find $\dfrac{380}{2} = \$190$ per week

An example would be:
He could take the budgeted \$40 from telephone and internet, \$40 from savings, \$70 from entertainment and \$ from clothes and gifts items. These are non-essential items. Leaving \$10 to spare.

Question 24

(a) (i) $4(y+2) - 3(y+1) = -3$
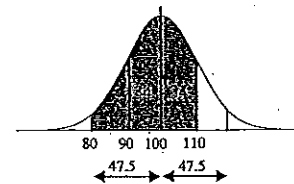$4y + 8 - 3y - 3 = -3$

(ii) $y + 5 = -3$
$y = -8$

(b) The point of intersection of the two graphs is when $x = 4$. This is the point where Ashley breaks even. At less than frames she loses money. At more than frames she makes a profit.

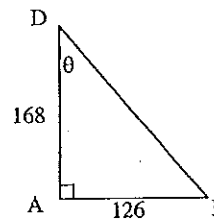**(c) (i)** $z = \dfrac{x - \bar{x}}{s}$
$= \dfrac{115 - 100}{10}$
$= 1.5$

(ii) 100
A z-score of zero shows that Mary's score is equal to the mean.

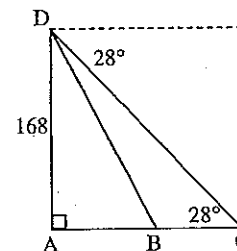**(iii)**

$47.5\% + 34\% = 81.5\%$

(d) (i)

$\tan\theta = \dfrac{opp}{adj}$
$\tan\theta = \dfrac{126}{168}$
$\theta = \tan^{-1}\left(\dfrac{126}{168}\right)$
$\theta = 36°52'$

Angle of depression $= 90° - \theta$
$= 90° - 36°52'$
$= 53°08'$

(ii)

$\tan 28° = \dfrac{168}{AC}$
$AC = 316$
$BC = AC - AB$
$BC = 316 - 126$
$= 190\ m$

Question 25

(a) (i) $(36, 350)$, $(70, 570)$, $(90, 900)$ are the summary points.

The lower and upper points are joined by a dashed line. Measure the vertical distance from the middle summary point to the dashed line. Calculate one third of this distance. Place your ruler on the dashed line and while keeping it on the same slope, move it one third distance towards the middle summary point. Draw the final regression line.
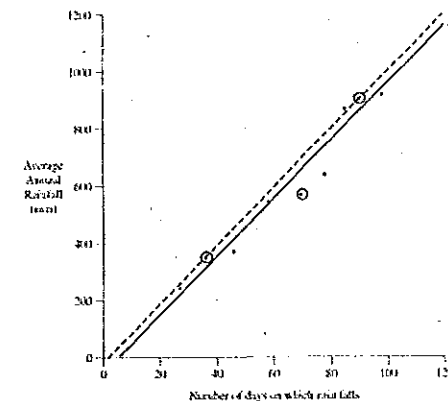
(ii) The average annual rainfall for a location with 120 days (using the constructed line) is 1180.

(b) A \$28000 loan at 7% p.a. has monthly repayments of \$670.49.
Total repayments $= \$670.49 \times 12 \times 4$
$= \$32183.52$
Total interest paid $= \$32183.52 - \$2800$
$= \$4183.52$

(c) (i) The angular distance $= 15° - 1°$
$= 14°$

Distance $= 14° \times 60$
$= 840$ nautical miles

Time taken $= \dfrac{840 \text{ nautical miles}}{15 \text{ knots}}$
$= 56$ hours

(ii) Difference in longitude $= 151° + 149°$
$$= 300°$$
Time difference $\quad = 300° \times 4$
$$= 1200 \text{ min}$$
$$= 20 \text{ hours}$$
Note: Sydney is east of Papeete.
At 7 pm on Friday in Sydney, it is
11pm on Thursday in Tahiti.

(d)
$$A = M\left\{\frac{(1+r)^n - 1}{r}\right\}$$
$$= 50\left\{\frac{(1+0\cdot005)^{36} - 1}{0\cdot005}\right\}$$
$$= \$5900\cdot42$$
The savings of $600 is compounded as well.
$$A = 600(1 + 0.005)^{36}$$
$$= 718.0083$$
$$= \$718.01$$
Total in account $= \$5900.42 + \$718.01$
$$= \$6618.43$$
Mark will not have enough money saved at the end of three years.

Question 26

(a) **(i)** $10 \times 10 \times 26 \times 26 \times 10 \times 10 =$
6 760 000 different number plates

(ii) 10^4 possible choices for numbers and only two are acceptable
$$P(\text{acceptable}) = \frac{\text{favourable outcomes}}{\text{total outcomes}}$$
$$= \frac{2}{10000}$$
$$= \frac{1}{5000}$$

(b) **(i)** $x = 25 - 10$
$$x = 15$$

(ii)
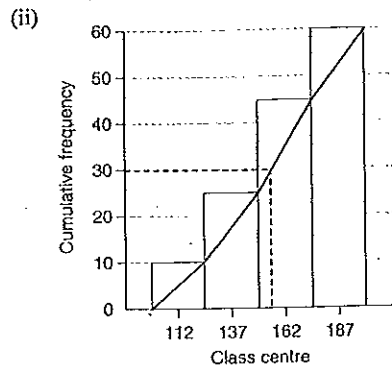
(iii) From the graph the median is 155

(iv) There will be a lot of traffic congesti⟨ from shopping.
Problems include:
- danger for young pedestrians, particularly in crossing the road
- difficulty in parents or buses pic⟨ up students

Solutions include:
- move access to the shopping cer⟨
- reduce speed eg speed bumps, e⟨
- closer supervision after school .

(c)
Expected $\quad = \frac{1}{5} \times 10 + \frac{1}{2} \times 3 + \frac{3}{10} \times -\langle$
$$= 1 \cdot 1$$
Expectation $= \$2.00 - \$1.10$
$$= -\$0.90$$
ie lose $0.90

(d)
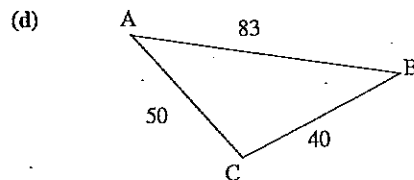
$$\cos C = \frac{c^2 - (a^2 + b^2)}{2ab}$$
$$= \frac{83^2 - (40^2 + 50^2)}{2 \times 40 \times 50}$$
$$= 0 \cdot 69725$$
$$\angle C = 45 \cdot 79°$$

Area $= \frac{1}{2}ab \sin C$
$$= \frac{1}{2} \times 40 \times 50 \times \sin 45 \cdot 79°$$
$$= 716 \cdot 83$$
$$= 717 \text{ m}^2$$

Question 27

(a)
$$\frac{4x^2}{3y} \div \frac{xy}{5} = \frac{4x^2}{3y} \times \frac{5}{xy}$$
$$= \frac{20x^2}{3xy^2}$$
$$= \frac{20x}{3y^2}$$

(b) **(i)** In 2000, 12 years is the median age and 18 years is the maximum age.
$\therefore$ 12 years to 18 years is 50% of the 1750 children ie 875 children.

(ii) In 2010, 12 years is the upper quartile (Q3) and 18 is the maximum age.
$\therefore$ 12 to 18 years is 25% of the number of children.
If 25% of the children is 875, then the total number of children in 2010 is:
$$4 \times 875 = 3\,500.$$

(iii) TWO changes from these:
- The median age has decreased from 12 to 6.
- The interquartile range has increased from 8 to 10.
- The distribution for 2000 is negatively skewed but for 2010 it is positively skewed.

(iv) Possible planning implications:
- Schools
- Pre-schools
- Health centres
- Day care
- Sporting facilities

(c) **(i)** From the graph, the tax payable on $21 000 is $3 000.

(ii) Choose two convenient points such as: (21 000, 3 000) and (30 000, 6 000) (Note: other points could be selected)
gradient $= \frac{\text{rise}}{\text{run}}$
$$= \frac{6000 - 3000}{30000 - 21000}$$
$$= \frac{3000}{9000}$$
$$= \frac{1}{3}$$

(iii) The gradient implies that $\frac{1}{3}$ of a dollar or $0.33 is paid as tax.

(iv) Using: $\quad m = \frac{1}{3}$ and (21 000, 3 000)
$$y = mx + b$$
$$3000 = \frac{1}{3} \times 21000 + b$$
$$3000 = 7000 + b$$
$$b = -4000$$
$$T = \frac{1}{3}I - 4000$$
or $\quad T = \frac{I}{3} - 4000$

Question 28

(a) **(i)** Change in repayments $= \$1588 - \$1573$
$$= \$15$$
ie a drop of $15 per month.

(ii) The repayment on $307 000 is:
$\$1942 + 7 \times \$6.47 = \$1\,987.29$
30% of Xiang's monthly gross salary is:
$$\frac{30}{100} \times 6500 = \$1950$$
Since $1950 < $1987.29 Xiang will not have her loan approved

(iii) Identify TWO of the following:
- Xiang's loan graph is smooth whereas Jack's has two distinct parts. This suggests that after 12 years either the loan repayments were reduced or the interest rate increased on Jack's loan.
- Although both loans started at the same balance, Xiang paid off her loan after 25 years and Jack paid off his loan after 30 years.
- The graph of Jack's loan started off below the graph of Xiang's loan, suggesting that he was either making higher monthly repayments or he had a lower interest rate.

(b) (i) Each can effectively uses a space of
$10 \times 10 \times 10 = 1\,000 \text{ cm}^2$
The number of cans that can be packed
in a box $= \dfrac{60 \times 30 \times 40}{1000} = 72$ cans

(ii) Area of 1 label is given by $A = 2\pi r h$
Height of a label $= 10 - 0.5 \times 2 = 9$ cm
Area of 72 labels:
Area $= 72 \times 2 \times \pi \times 5 \times 9$
$= 20357.5204$
$= 20358 \text{ cm}^2$ (0 dp)

(iii) $V = \pi r^2 h$
Using $r = 5$ and $h = 10$:
$V = \pi \times 5^2 \times 10$
$= 785 \cdot 4 \text{ cm}^3$
Doubling the diameter would also double the radius: $r = 10$ and $h = 10$
$V = \pi \times 10^2 \times 10$
$= 3141 \cdot 6 \text{ cm}^3$
(Note: $3141.6 = 4 \times 785.4$)
The volume increases by a factor of 4.
$\therefore$ Monica is not correct.

OR

$V_{old} = \pi r^2 h$
$V_{new} = \pi \times (2r)^2 \times h$
$= 4 \times \pi r^2 h$
$= 4 \times V_{old}$
$\therefore$ Monica is not correct.

(iv) From the first graph the minimum surface area occurs when the radius is approximately 6 cm. Using this value of radius on the second graph gives an approximate height of 14 cm.
(Height seems to be between 13 and 14)

End of General Mathematics solutions