THE KING'S SCHOOL

General Mathematics

General Instructions

- Reading time – 5 minutes
- Working time – 2.5 hours
- Write using a black or blue pen
- Board-approved calculators may be used
- A formulae sheet is provided at the back of this paper
- Write your student number and/or name at the top of every page

Total marks – 100

Section 1 Pages 2-13
Total marks (22)

- Attempt Questions 1-22.
- Answer on the Multiple Choice answer sheet provided.
- All about 30 minutes for this Section.

Section II Pages 14-25
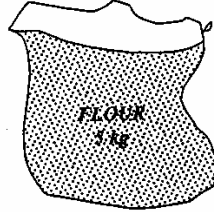Total marks (78)

- Attempt Questions 23-28

Allow about 2 hours for this section.

This paper must not be removed from the examination room
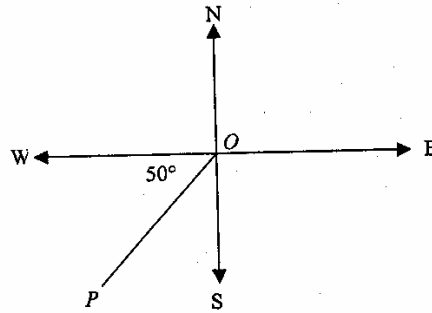
1. When 35% of the flour in the 5 kg bag is used, what weight remains?

(A) 175g
(B) 650g
(C) 1·75kg
(D) 3·25kg
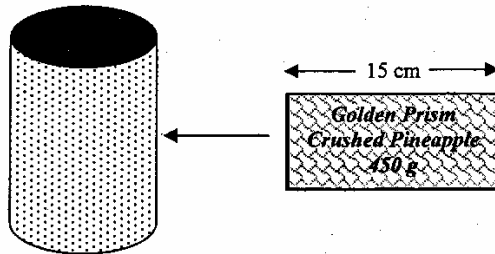
2. The position of P relative to O can be correctly described by:

(A) S 50° W
(B) N 140° W
(C) 230° T
(D) 220° T

3. The 15 cm label is to be attached to the can by a machine in the factory so that it completely fits around the can with no overlap.

The radius of each of the cans is approximately:

(A) 7·5 cm
(B) 6 cm
(C) 4·8 cm
(D) 2·4 cm

4. The standard deviation is a statistical measure which:

(A) adjusts the recorded statistics to a higher standard.
(B) gives the degree to which the recorded statistics are spread about the mean.
(C) describes the skewness of the distribution of recorded statistics.
(D) gives the accuracy of the recorded statistics.

5. In a particular week, James works the number of hours shown in the table:

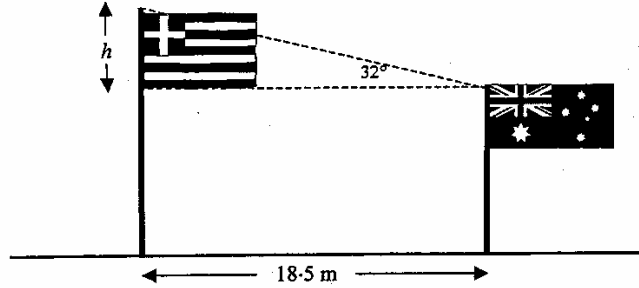| Hours Worked			
Employee	Normal Hours	Hours × 1·5	Gross Wage
James T.	28	6	$ 592

According to the information in the table, the hourly rate at which James was paid was:

(A) $16·00
(B) $17·41
(C) $18·50
(D) $20·82

6. The flags of Greece and Australia are shown standing on level ground in Athens for the 2004 Olympic Games.

The horizontal distance between the flags is 18·5 metres, and the angle of elevation between the flags is 32° as shown.

The height of the Greek flag (h) above the Australian flag is approximately:

(A) 9·8 m
(B) 11·6 m
(C) 15·7 m
(D) 29·6 m

7. A hole in the shape of an ellipse with axes 10 cm and 8 cm is to be cut from a thin rectangular piece of metal with dimensions as shown:
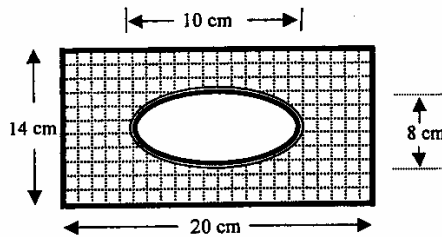
The area (to the nearest square centimetre) of metal remaining after the hole is cut out is:

(A) 29
(B) 154
(C) 201
(D) 217

8. The time T (in seconds) for a single swing of the pendulum in the clock is given by the formula:

$$T = \sqrt{\frac{L}{9.8}}$$ where L is the length of the pendulum

If it takes 4 seconds for a single swing of the pendulum, the length of the pendulum can be determined by:

(A) $4 \times \sqrt{9.8}$
(B) 4×9.8^2
(C) 16×9.8
(D) 16×9.8^2

9. Two cities P and Q both lie on the Equator and have respective longitudinal positions of 110° W and 150° E as shown.
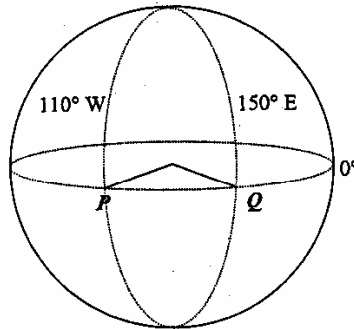
When it is 10:15 pm on Tuesday in city Q, the time in city P is:

(A) 9:43 am Wednesday
(B) 4:55 am Tuesday
(C) 9:35 am Wednesday
(D) 6:55 pm Tuesday

Page 6

10. In order to direct shoppers into a new car park on the opening day of a shopping complex, two similar signs with lengths as shown are placed outside the car park.

    25 cm   75 cm
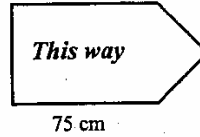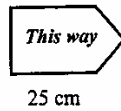
The area of the smaller sign is $1 \cdot 5 \text{ m}^2$

The area of the larger sign is:

(A) $4 \cdot 5 \text{ m}^2$
(B) $13 \cdot 5 \text{ m}^2$
(C) $51 \cdot 5 \text{ m}^2$
(D) $112 \cdot 5 \text{ m}^2$

11. If $a = -2$ and $b = -4$, the value of $1 - 2a - 3b^2$ is:

(A)   -32
(B)   -43
(C)   -139
(D)   146

12. Tourists in London can choose one of two bus companies for tours of the city. The two-way table gives the number of buses that operate tours on any day.

	Full Day Tour	Half Day Tour
Red Bus	20	25
Blue Bus	12	38

The percentage of buses from these companies operating half day tours is:

(A)   60·3
(B)   63
(C)   65·8
(D)   66·3

13.   The following box and whiskers graph shows the ages of people in Redwood
      Retirement Village. Which of the following statements is correct?

Age in years
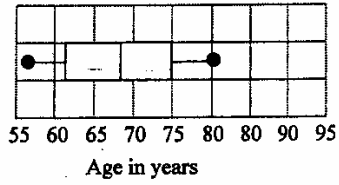
(A)   a quarter of the people are aged between 55 and 65
(B)   a quarter of the people are aged between 75 and 80
(C)   half the people are over 70
(D)   half the people are under 75

14.

The correct equation of the line l shown in the diagram is:

(A) $y = -6x - 8$

(B) $y = \dfrac{3}{4}x - 6$

(C) $y = \dfrac{-3x}{4} - 8$

(D) $y = \dfrac{-4x}{3} - 8$

15.   The 36 chips in the bag each have a letter of the alphabet written on them.

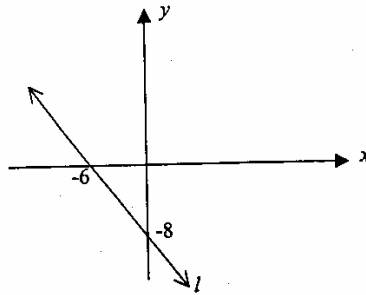The vowels A, E, I, O and U appear 3 times each, and the remaining letters (consonants) appear once each.

Jasmin has randomly selected 6 letters from the bag and has placed them together to spell S C A L E N

In order to spell the word SCALENE, Jasmin needs the letter E as her next selection. The probability that Jasmin will spell the word correctly is:

(A) $\dfrac{1}{2}$ (C) $\dfrac{1}{15}$

(B) $\dfrac{1}{6}$ (D) $\dfrac{1}{30}$

16. If $a = 2\sqrt{b}$, then $b =$

   (A) $4a$

   (B) $2a^2$

   (C) $\dfrac{a^2}{4}$

   (D) $4a^2$

17. The speed (v) of a ski lift travelling up an incline is inversely proportional to the weight (W) it carries.

   A ski lift carrying a weight of 450 kg can move up the incline at 15 km/hr.

   If the weight carried by the lift drops to 350 kg, the speed the lift can move up the incline can be determined by calculating:

   (A) $\dfrac{350 \times 15}{450}$ (C) $\dfrac{450 \times 15}{350}$

   (B) $\dfrac{350 \times 450}{15}$ (D) $\dfrac{450}{350 \times 15}$

18   The digits 1, 2, 3, 4 and 5 are written on five separate cards.

   | 1 | 2 | 3 | 4 | 5 |

   Three cards are drawn at random from the deck, one at a time, and placed face up on a table to form a three-digit number. How many different three-digit numbers can be formed?

   (A)   10

   (B)   60

   (C)   120

   (D)   125

19. A new plasma television is purchased for $11 250.

At the end of each year the declining balance method of depreciation is used to estimate the value of the TV.

If the annual rate of depreciation used is 18%, the value of the TV at the end of 4 years use, is approximately:

(A) $9 225
(B) $8 100
(C) $6 164
(D) $5 086

20. The two bunkers A and B on the golf course are 35 metres and 60 metres respectively from the hole at H.

The angle AHB is 40°.
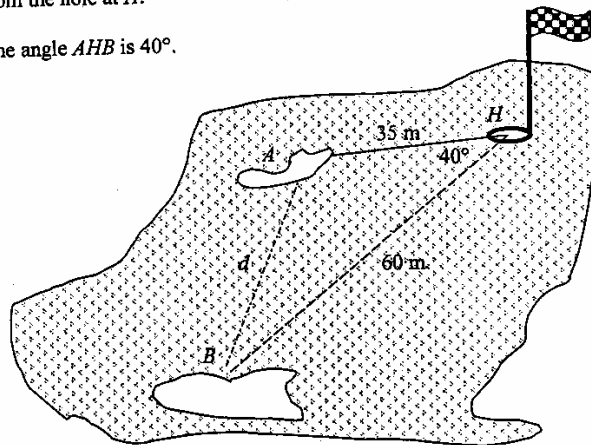
The distance (d) between the bunkers can be determined by which of the following calculations?

(A) $\sqrt{35^2 + 60^2 - 2 \times 35 \times 60 \times \cos 40°}$

(B) $35^2 + 60^2 - 2 \times 35 \times 60 \times \cos 40°$

(C) $\dfrac{1}{2} \times 35 \times 60 \times \sin 40°$

(D) $\dfrac{60}{\sin 40°} \times 35$

21. The co-ordinates of Viti Levu are 18°S,178°E. If Tahiti is 53° east of Viti Levu then its co-ordinates are?

    (A)   51°S,178°E
    (B)   18°S,145°E
    (C)   18°S,211°E
    (D)   18°S,149°W

22. The following graphs show the amount remaining on a loan of $50 000 after regular monthly payments have been made over a period of 144 months.

    The curves show the comparison between monthly repayments of $600 and $750.
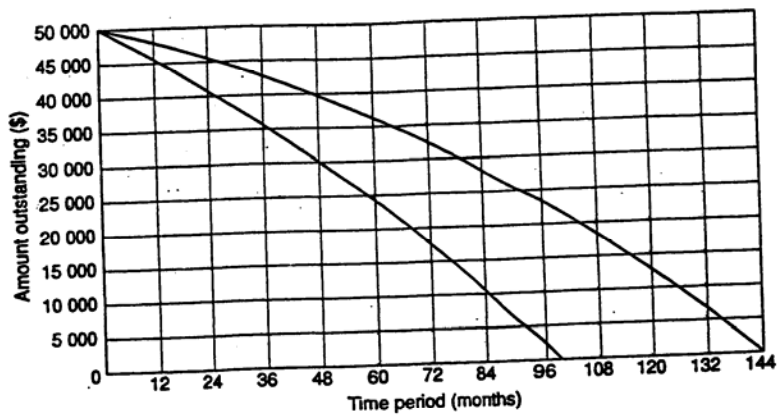
    After 4 years of regular monthly repayments of $600, the total amount of interest that has been paid is:

    (A) $30 000
    (B) $25 000
    (C) $18 800
    (D) $15 000

End of Section I

Section II
Total Marks (78)

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

Answer the questions on the paper provided, beginning each new question on a new page.

Question 23 (13 marks)

Marks

(a) The graph below shows the recorded temperatures in the different layers of the atmosphere at various heights above the Earth's surface.
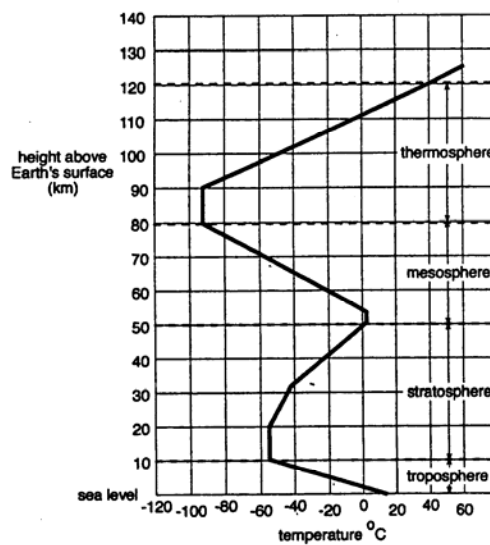
(i) What is the closest layer to the Earth's surface to have a temperature of 60° below zero recorded?

1

(ii) What height above the Earth's surface recorded the coldest temperatures?

1

(iii) Describe the trend in temperatures recorded in the Stratosphere.

1

(iv) Determine the approximate range in temperature recorded in the Thermosphere.

1

Question 23 continued

Marks

(b)　An old highway joins four towns A, F, E and D as shown in the diagram below.

Diagram not to scale

New Highway ——

Old Highway _ _ _

15 km

16 km

13 km

It is proposed that a new highway be built from town A to town D to shorten the travelling time between the main towns.
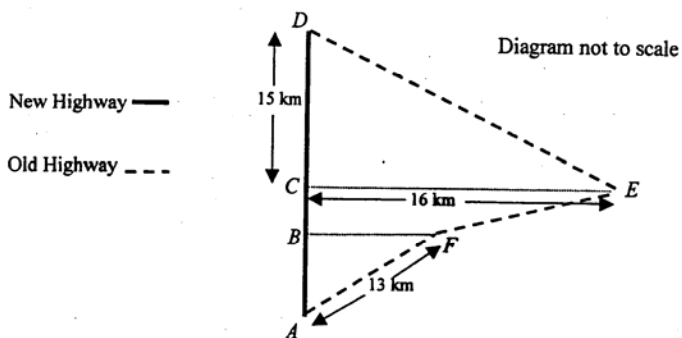
An offset survey was made by an engineer of the proposed area enclosing the old and new highways and the surveyor's notes are shown:

D	
32	
x	16 (E)
12	y (F)
A	

(i)　What is the length of the new highway joining towns A and D?　　　　　**1**

(ii)　Calculate the distance represented by y in the surveyor's notes.　　　　**2**

(iii)　Explain why $x = 17$ in the surveyor's notes, and write down the distance represented by BC in the length of new highway.　　　　**2**

(iv)　Calculate the area of the section $BCEF$ between the old and new highways.　　　　**2**

(v)　The new highway costs $625 850 for every 100 metres of construction. Determine the total cost of constructing the new highway.　　　　**2**

Page 15

Question 24 (13 marks) Begin a new page   **Marks**

(a)

Income	Tax Payable
$1 to $6000	$0
$6001 to $20 000	$0 plus 17c for each $1 over $6000
$20 001 to $50 000	$2380 plus 30c for each $1 over $20 000
$50 001 to $60 000	$11 380 plus 42c for each $1 over $50 000
In excess of $60 000	$15 580 plus 47c for each $1 over $60 000

(i)   A man earns an annual salary of $57 750. He also earns $120 in bank interest
and has allowable deductions totalling $2150. What is his taxable income?   **1**

(ii)   Calculate the tax payable on his taxable income.   **2**

(iii)   If the Medicare Levy is 1½% of taxable income, calculate the amount he has to
pay.   **1**

(iv)   If he has paid $15 501.25 in tax instalments throughout the year, calculate
whether he will receive a refund or have to pay additional tax and the amount
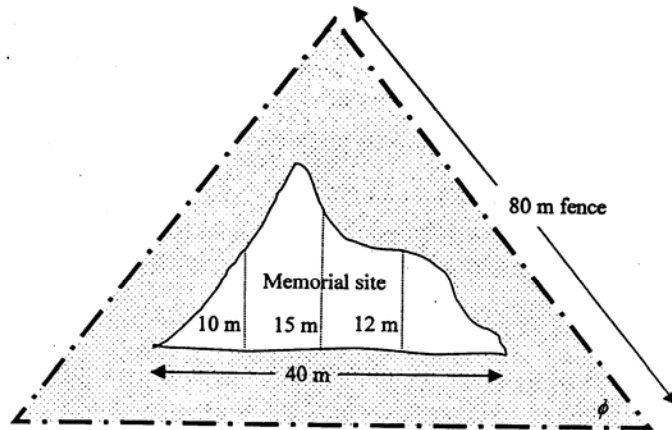involved.   **2**

Question 24 continued

Marks

(b)   A memorial site commemorating the late Princess of Wales has been built in a section of Hyde Park in London.

A fence, in the shape of an equilateral triangle of side 80 metres, surrounds the memorial site. The memorial site is 40 metres wide and irregularly shaped as shown in the diagram below.

Perpendicular measurements (all in metres) have been taken across the memorial site at equal intervals as shown.

(i)   Using Simpson's rule, calculate the approximate area of the memorial site.   3

(ii)   Write down the size of the angle represented by ϕ in the triangle.   1

(iii)   Calculate the area within the fence but surrounding the memorial site.   3

Question 25 (13 marks) Begin a new page

(a)
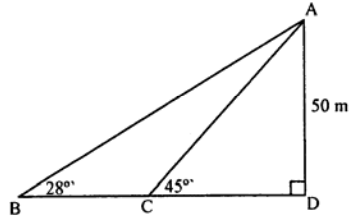
(i) Find the length of CD. 1

(ii) Find the length of BC, correct to 1 decimal place. 2

(b) Use the sine rule to find the length of x correct to 1 decimal place. 3

Question 25 continued on next page

Question 25 continued

Marks

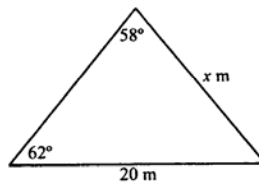(c) In most of their tests Chris and Barney have the same average, but in German, Chris's average, over the 5 tests that have had is 6.5 while Barney's is 7. If Barney gets 7 in the next test, what must Chris get to also have an average of 7?

2

(d) Petra surveyed the 120 year 12 students at her high school to find out how many times a week they went out during term time including work. She summarised the results in the following graph.

Number of outings per week
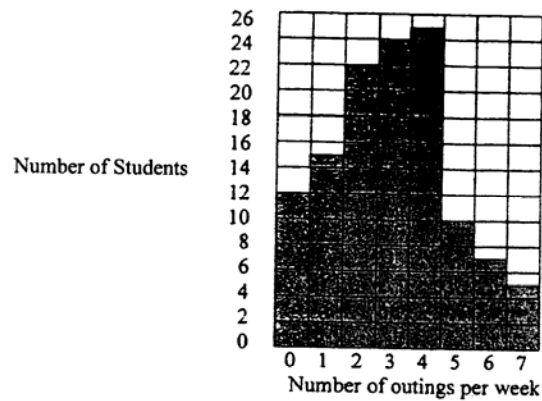
(i) What is the mean for the above scores (correct to 2 decimal places)?

1

(ii) Calculate the standard deviation (correct to 2 decimal places)?

1

(iii) What is the range of scores?

1

(iv) Give a feature of the distribution of the displayed data.

1

(v) What is the median score of outings?

1

Question 26 (13 marks) Begin a new page

Marks

(a)   A student's PIN number is made up of the four different digits 3, 5, 8 and 9.

    (i)   If he has forgotten his number, what is the probability that he will guess the correct combination the first time?

2

    (ii)   If he is certain the first number is 5, what is the probability he will guess the correct combination?

2

(b)   The carton contains 4 eggs and it is known that one egg is stale.
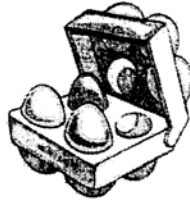
One egg has been removed from the carton.

    (i)   What is the probability that the egg removed was a fresh one?

1

    (ii)   Suppose the first egg removed was a fresh egg. If a second egg is removed from the carton, what is the probability that this second egg is fresh?

1

    (iii)   What is the probability that one of the first two eggs removed from the carton is stale?

1

    (iv)   What is the probability that the last egg removed from the carton will be the stale one?

1

Question 26 continued

Marks

(c) The numbers 1 to 20 are on a wheel. When the wheel is spun, a player wins $10 it if stops on 13, $5 if it stops on 11 and $1 if it stops on 7. He loses $1 if it stops on any other number.

    (i)   What is the financial expectation of this game?

3

    (ii)   If a man plays 100 times, how much would he expect to win or lose?

1

    (iii) What is the probability he will win on any one spin?

1

Question 27 (13 marks) Begin a new page   **Marks**

(a)   Sally and Peta have determined that they will need $130 000 to open a fashion boutique
      in 5 years time.

      They plan to make regular monthly contributions of $2 000 into an investment account
      which pays interest at the rate of 6% p.a. compounded monthly.

    (i)   What is the monthly interest rate written as a decimal?   **1**

    (ii) A financial advisor suggests to Sally and Peta that this investment strategy
        should allow them to exceed the amount they require by about $10 000.   **2**
        By calculation, explain whether the advice given to them is correct.

    (iii) Determine the interest Sally and Peta will have earned on their investment.   **2**

    (iv) How much would Sally and Peta have needed to invest in a lump sum now to
        have the required $130 000 in 5 years time?   **2**
        (Assume that the interest rate is the same and paid monthly)

Question 27 continued   Marks

(b)   Fossil samples from two different archaeological sites have been collected and their weights recorded in grams in the back-to-back stem and leaf plot shown below.

Weights of fossil samples (g)										
Site A					Site B					
				1	4					
			8	2	0	1	4	6		
	8	6	2	3	2	3	4	5	6	
9	7	6	6	4	3	4	4	5	7	
9 9	8	6	4	5	2	6	7			
8	6	4	1	6	1					
	2	1	0	7						

(i)   The five-number summary for the fossils collected at Site A is shown in the table below.

Fossil Samples	Site A	Site B
Minimum weight	28	
Lower Quartile	46	
Median	57	
Upper Quartile	65	
Maximum weight	72	

Using the data in the stem-and-leaf plot, write down the five-number summary for the weights of the fossil samples collected from Site B   3
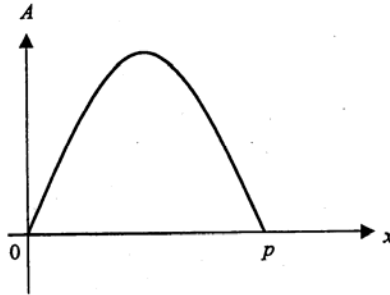
(ii)   Compare and contrast the sample fossil weights from the two sites.   3

Question 28 (13 marks)   Begin a new page

(a)   The area (A) of a rectangular farmyard of length x metres is given by the formula:

$A = 40x(20 - x)$ where A is in square metres

The graph of A against different x values is shown in the diagram below:

(i)   Write down the value of p on the graph.   1

(ii)   What should the farmyard length be in order to have maximum area?   1

(iii) Determine the maximum area of the farmyard.   1

(iv)   Determine the area of the farmyard by using $x = 5$.   1

(v)   Explain, without any calculation, why $x = 15$ will give the same area as $x = 5$.   1

Question 28 continued on next page

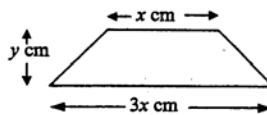Question 28 continued   **Marks**

(b)   A design is to be made from 8 identical trapeziums.
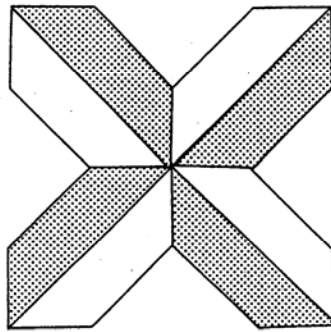
One trapezium is shown below:

The perpendicular height of each trapezium is y cm and the two parallel lengths are
x cm and $3x$ cm.

(i)   Show that the area (A) of each trapezium can be written as $A = 2xy$ cm^2 1

(ii)   If the design has area 320 square centimetres, show that $y = \dfrac{20}{x}$ 2

(iii) On the grid sheet provided, draw the graph of $y = \dfrac{20}{x}$ for values of x from

       $x = 1$ to $x = 5$.   2

(iv)   Using your graph, explain how the values of y change as the values of x increase. 1

(v)   The area of the design is to be increased to 400 cm^2. On the same diagram, draw
       the graph which shows the new values of y, using the same x values, and clearly
       label this graph with its equation.   2

End of paper

General Maths

Trial HSC   August, 2004.

1. D   2. D   3. D   4. B   5. A   6. B

7. D   8. C   9. B   10. B   11. B   12. D

13. B   14. D   15. C   16. C   17. C   18. B

19. D   20. A   21. D   22. C

Q23 (a) (i) Mesosphere (ii) 80-90 km (iii) as height
increases, temperature increases (iv) -90° to 40° range 130°
(b) (i) 32km (ii) 5 km (iii) proof (iv) 52.5 km (v) $200272000

Q24 (a) (i) $55720 (ii) $13782.40 (iii) $835.80 (iv) $883.05
(b) (i) 393.3 m² (ii) 60° (iii) 2375 m² (nearest m²)

Q25 (a) (i) 50 m (ii) 440 m (b) 20.8 m (1 dec pl) (c) 9.5
(d) (i) 3.97 (ii) 2.94 (iii) 7 (iv) pos skewed (v) 3

Q26 (a) (i) $\frac{1}{24}$ (ii) $\frac{1}{6}$ (b) (i) $\frac{3}{4}$ (ii) $\frac{2}{3}$ (iii) $\frac{1}{2}$ (iv) $\frac{1}{4}$ (c) (i) -$0.05 (ii) lose $5
(iii) $\frac{3}{20}$

Q27 (a) (i) 0.005 (ii) A=$139540 advice correct (iii) $19540.06
(iv) $96378.39 (b) (i) 14, 26, 36, 47, 61
(ii) B normal A neg skewed — interquartile range similar
B smaller median lowest weight.

Q28 (a) (i) 20 (ii) 10 (iii) 4000 m² (iv) 3000 m² (v) symmetry
(b) (i) proof (ii) proof (iii)

x	1	2	3	4	5
y	20	10	6⅔	5	4

(iv) x inc, y dec
+ graph

(iv)

x	1	2	3	4	5
y	25	12½	8⅓	6¼	5

+ graph