THE SCOTS COLLEGE
Sydney

2005
TRIAL H.S.C.
EXAMINATION

General Mathematics

General Instructions
- Reading time – 5 minutes
- Working time – 2½ hours
- Write using black or blue pen
- Board-approved calculators may be used
- Use the Multiple Choice Answer Sheet provided
- Use graph paper provided for Question 25 (b)
- A separate formula sheet is provided
- All necessary working should be shown in every question

Total marks – 100
Section I
- Total marks 22
- Attempt Questions 1-22
- Allow about 30 minutes for this section

Section II
- Total marks 78
- Attempt Questions 23-28
- Allow about 2 hours for this section

Section 1
Total Marks (22)
Attempt questions 1-22
Allow about 30 minutes for this section

Select the alternatives A, B, C or D that best answers the question and indicate your choice with a cross (X) in the appropriate space on the **Section 1 answer sheet attached.**

1.   Express 0.001 232 correct to 3 significant figures.

   A)   0.001   B)   0.001 23   C)   0.001 230   D)   0.001 232

2.   Solve the equation $\dfrac{3x+2}{2} = 7$

   A) $x = \dfrac{16}{3}$ B) $x = 4$ C) $x = \dfrac{10}{3}$ D) $x = 2$

3.   In 7 games of cricket a batsman has an average of 13 runs. In the next game he scores 21 runs. What is his new average?

   A)   13   B)   14   C)   15   D)   17

4.   Find the distance, in kilometres to the nearest 100 km, between two places on the same meridian with latitudes 8^0 N and 12^0 S.

   A)   400 km   B)   500 km   C)   2200 km   D)   2000 km

5.   The range of values for a measurement of 15.6 cm is:

   A)   15-16 cm   B)   14.6-16.6 cm

   C)   15.5-15.7 cm   D)   15.55-15.65 cm

6. Romeo works for 6 normal hours and 4 hours overtime at time and a half. He was paid a total of $180. What is his normal hourly rate of pay?

A) $18   B) $13   C) $20   D) $15

7. The results for Juliet's assignments this term are: 52, 44, 49, 47, 47, 53, 55, 51. What is her median score?

A)   49   B)   47   C)   48   D)   50

8. If 4 is added to each score in a set, which one of the following statements will be true?

A)   The mean and standard deviation will remain the same.

B)   The mean will increase by 4 and the standard deviation will remain the same.

C)   The mean will increase by 4 and the standard deviation will increase by $\sqrt{4}$.

D)   The mean will increase by 4 and the standard deviation will increase by 4.

9. This table shows monthly repayments for various amounts borrowed and different annual interest rates for a term of 20 years.

Amount borrowed	Monthly repayment			
	5% pa	6% pa	7% pa	8% pa
$10 000	$66.00	$71.64	$77.53	$83.64
$15 000	$98.99	$107.46	$116.29	$125.47
$20 000	$131.99	$143.29	$155.06	$167.29
$25 000	$164.99	$179.11	$193.82	$209.11

The total interest paid over the term of a loan of $15 000 at 6% pa is:

A) $1 289.52   B) $5 790.40   C) $10 790.40   D) $25 790.40

10. Simplify fully $10(x+3) - 2(4x-1)$

A) $6x+29$ B) $2x+32$ C) $2x+28$ D) $6x+32$

11. The inflation rate is 6% pa. What would you expect to pay in 3 years time for a house that now costs $250 000?

A) $15 000   B) $295 000   C) $297 754   D) $750 000

12. A normal distribution of scores has a mean of 56 and a standard deviation of 9. Within what range of scores will a z-score of between -3 and 3 occur?

A) 53 to 59   B) 47 to 65   C) 38 to 74   D) 29 to 83

13. The volume of a sphere is 14 100 cm^3. What is the best estimate of the radius of this sphere:

A) 33 cm   B) 7 cm   C) 15 cm   D) 58 cm

14. If $y = \dfrac{m+18}{3m}$ and $m = 7.4$, what is the value of y (correct to 2 decimal places)?

A) 1.14   B) 8.21   C) 51.80   D) 62.65

15. A toaster manufacturer tests every 20th toaster. What type of sampling is this?

A) Biased sampling   B) Random sampling

C) Stratified sampling   D) Systematic sampling

16. Which of the following statements is true about this box-and-whisker plot?

A) The median is 5 and the range is 6   B) The median is 5 and the range is 3

C) The mean is 5 and the range is 6   D) The mean is 5 and the range is 3

17.
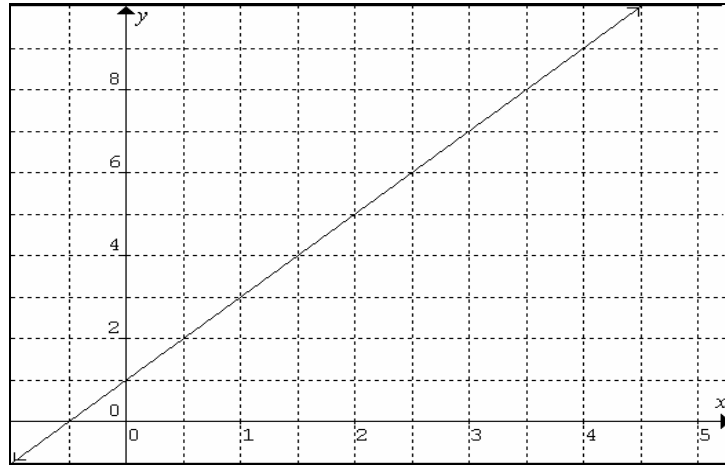
A line of best fit is drawn, as shown above. What is the correct equation for this line?

A) $y = 2x + 1$ B) $y = x + 2$ C) $y = x + 1$ D) $y = -2x + 1$

18. Find the standard deviation for the following numbers, correct to one decimal place.

4, 7, 8, 9, 5, 8, 10

A) 2.0   B) 1.9   C) 1.4   D) 3.9

19. Calculate the interest on $2 000, invested for 3 years at 3.75% per annum, compounding each year.

A) $2 233.54   B) $225   C) $233.54   D) $75

20. Each dimension of a rectangular mirror is increased by 6%. The percentage increase in the area of the mirror is closest to:

A) 6%   B) 15%   C) 12%   D) 13%

21. A ship sails 9 nautical miles north, then 12 nautical miles east. What is the ship's bearing from its starting point?

A) 037^0 B) 053^0 C) 217^0 D) 233^0

22. A coin is tossed and a die is thrown. What is the probability of tossing a head and a number less than 5?

A) $\dfrac{1}{4}$ 　　　　B) $\dfrac{1}{6}$ 　　　　C) $\dfrac{1}{12}$ 　　　　D) $\dfrac{1}{3}$

End of Section 1

Section 2
Total marks (78)
Attempt all questions 23-28
**Allow approximately 2 hours for this section**
Start a new page for each question.

Question 23   **Start a new writing booklet**   **(13 marks)**

a)   A chocolate mousse dessert is made and poured into cone-shaped glasses. The glasses are filled to the top and then cooled in the refrigerator until the chocolate mousse mix is set. The glasses, as shown in the diagram, have a diameter of 9 cm and a height of 12 cm.
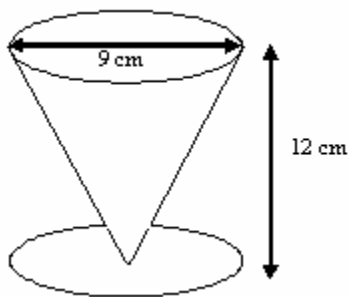

         i)   Find the volume of chocolate mousse dessert required to fill the glass, correct to the nearest cm^3.   2

         ii)   If the same quantity of dessert, found in part i), is poured into a cylindrical dessert glass of diameter 6cm, how high will the glass need to be in order that it be filled to the top? Answer to the nearest cm.   2

b)   The formula for the volume of a sphere is given by

$$V = \frac{4}{3}\pi r^3 \qquad \text{where} \quad V = \text{volume}, \ r = \text{radius}.$$

         i)   Calculate the volume of a sphere where the radius is 3 cm, to 1 decimal place. 1

         ii)   Rearrange the equation to make r the subject.   1

         iii)   Calculate the radius of a sphere where the volume is 34 cm^3. Write your answer correct to 1decimal place.   1

c) At the end of each season the cricket club gives awards for Best and Fairest Player, Most Improved Player and Best Team Player. If there are 16 players in contention for the awards, and each award must go to a different person, find the number of different ways they can be awarded. 1

d) i) Using Simpson's rule twice, estimate the area of the irregular shape PQRS given that PQ=28. All measurements are in metres.
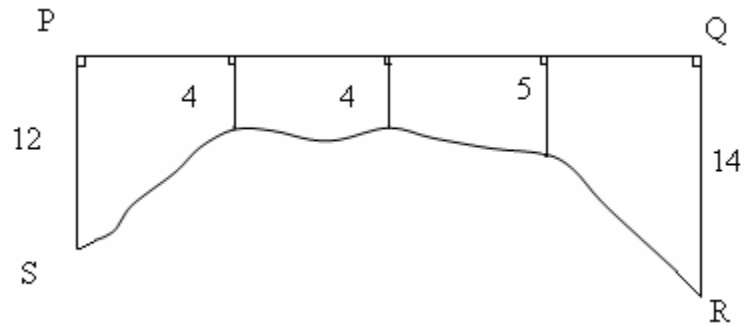
ii) Find the cost of fertilising the entire field at $12.50 per square metre. 3

e) Solve the equation $3(x+4) - 2(x-3) = 0$ 2

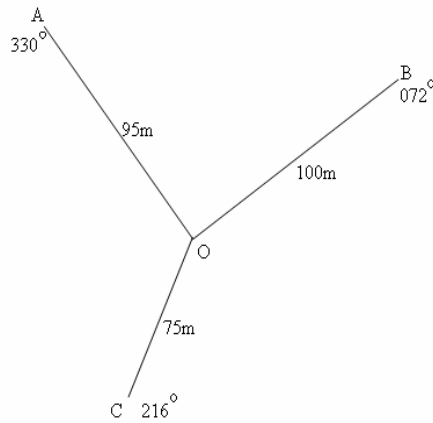**Question 24**   **Start a new writing booklet**   **(13 marks)**
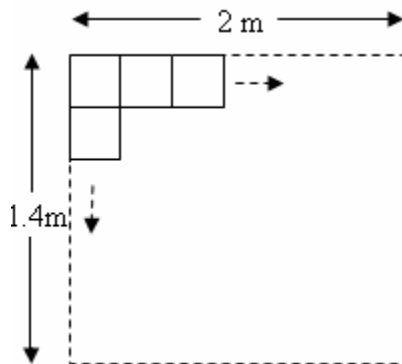
a)   The results of a compass radial survey are shown in the diagram below.

(NOT TO SCALE)

    i) Find $\angle AOB$.   1

    ii) Find the length of the boundary AB, to 1 decimal place.   2

    iii) Find the area of ΔAOB, to the nearest m^2.   2

b)   A wall, 2m by 1.4m as shown below, is to be tiled with 5 cm square mosaic tiles.

    i)   How many 5 cm square mosaic tiles will be required to completely tile the wall? 2

    ii)   It is suggested that if we choose mosaic tiles which are double the size of the originals, that is 10 cm square tiles instead of 5 cm square tiles, that it will require only half as many tiles to completely tile the wall.

        Do you agree with this suggestion? Justify your answer.   2

c) A car was test driven at various speeds and the petrol consumption was recorded. The results are shown in the following graph.
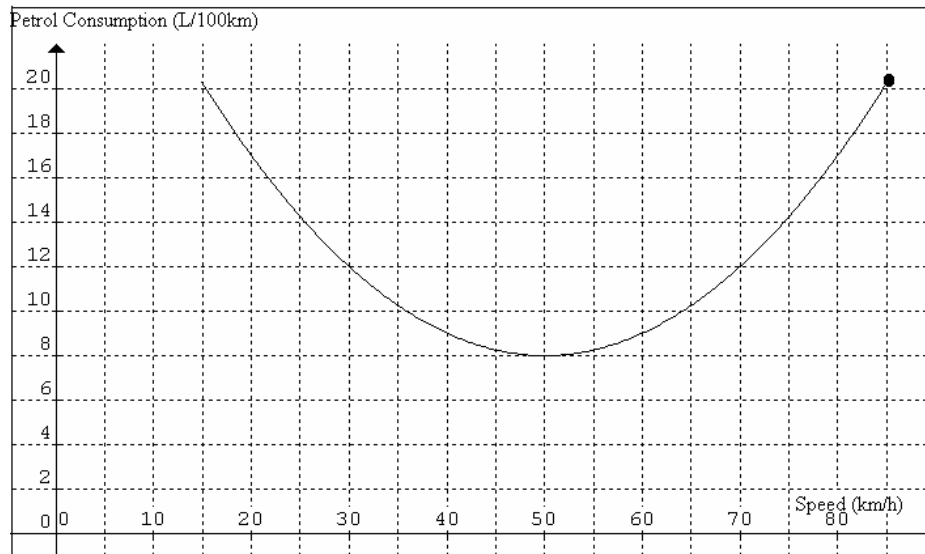
i) What was the petrol consumption recorded at 30 km/h? 1

ii) During the test, the car was driven at 50km/h for 50 km. How much petrol did it consume? 1

d) The height of students at a particular ballet school is known to follow a normal distribution with a mean of 152.5 cm and a standard deviation of 4.3 cm. Find the interval, correct to 1 decimal place, in which you would expect to find:

i) 68% of the population 1

ii) 99.7% of the population. 1

Question 25   **Start a new writing booklet**   **(13 marks)**

a)   *S* varies inversely to *T*.

  i)   Write an equation relating *S*, *T* and *k*, where *k* is the constant of variation.   1

  ii)   If *S* = 20 when *T* = 2.5, find the value of *k*.   1

  iii)   If *S* = 10, find the value of *T*.   1

  iv)   If *T* = 1.6, find *S*.   1

b)   On the graph paper provided, draw the three - median regression line for the data below. (Show all working).   4

Length of paper route (km)	10	11	12	13	14	15	16	17	18
Payment ($)	10	12	14	10	20	21	18	20	22

c)   A golfers scores were recorded.

  His last ten rounds with his old clubs were:

  83, 90, 86, 85, 92, 87, 79, 89, 84, 83

  His first ten rounds with his new clubs were:

  84, 76, 80, 85, 79, 82, 84, 80, 81, 82

  i)   Find the mean and standard deviation for both the old clubs and the new clubs, to 1 decimal place.   2

  ii)   In golf, the lower the score the better the player performed in that round. Did his game improve with his new clubs? Justify your answer.   1

  iii)   With which set of clubs was his game more consistent? Give a reason for your answer.   2

Question 26   **Start a new writing booklet**   **(13 marks)**

a)   A group of six people consists of Clare, Stuart, Sue, Leon, Peter and Anna.

         i)   How many ways can they be arranged in a line?   1

         ii)   From this group of six, three people are chosen to help in selling chocolates.

                How many different groups of three can be chosen?   1

         iii)   What is the probability that Sue, Leon and Peter are chosen as the three people to

                help sell the chocolates?   1

b)   Eight digit phone numbers are issued for the Sydney Metropolitan area. If the first digit

      must be 9, and the digits can be repeated, how many different numbers can be issued?   1

c)   Townsville in Queensland is located at 19°S, 147°E and Port Moresby in New Guinea is
      located at 9°S, 147°E.

         i)   How far is it from Townsville to Port Moresby? Give your answer to the nearest
               nautical mile.

                                                                      2

         ii)   If a yacht sailed from Townsville at 10am on 4th December, when would it arrive
               in Port Moresby (to the nearest hour) if it averaged 10.5 knots on the journey?   3

d)   Anna wishes to calculate the future value of an ordinary annuity where $150 is paid at the
      end of each month for 4 years into an account paying 12% p.a. compounded monthly.
      This is her solution:

$$r = \frac{12\%}{12} = 1\% \qquad\qquad n = 4 \text{ years} \qquad\qquad M = \$150$$

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

$$= 150\left\{\frac{(1+1)^4 - 1}{1}\right\}$$

$$= 150 \times 15$$

$$= \$2\,250$$

         i)   Identify the two mistakes that Anna made.   2

         ii)   Find the correct answer to this annuity problem, showing all working.   2

Question 27   **Start a new writing booklet**   **(13 marks)**

a)   A computer purchased for $10 450 is depreciated over 6 years at 15% per annum using the straight- line method.

     i)   Find the salvage value of the computer.   2

     ii)   Find the book value of the computer after 2 years.   2

b)   In a Geography test, Andrew was given a z – score of 1.8 and Robert was given a z –score of -2.5.

     i)   Who did better in the test? Justify your answer.   2

     ii)   If the mean mark was 65 and the standard deviation was 12, calculate Andrew and Robert's marks (to the nearest whole percentage).   2

c)   The Lion Credit Union published the following table for flat rate loans.

Years to repay loan	Monthly repayments (per $1000)
1	$91.25
2	$49.58
3	$35.69
4	$28.75
5	$24.58

Nathaniel borrowed $20 000 over 5 years.

     i)   How much does he repay per month?   1

     ii)   What is the total amount to repay the loan?   1

     iii)   What is the interest charged?   1

     iv)   Calculate the flat interest rate per annum?   2

Question 28   **Start a new writing booklet**   **(13 marks)**

a)   Phil has a credit card which has no interest-free period and charges an annual rate of
        12.75%.

      i)   Find the amount of interest charged on a purchase of $152.36 if the full debt is
               repaid 21 days later.   1

      ii)   What percentage, correct to two decimal places, of the total price paid (cost plus
               interest) is the interest?   1

b)   Determine the single amount to be invested at 4.2% per annum compounded monthly in
        order to provide for a series of monthly payments of $615 for 20 years.   4

c)   On an obstacle course for new Army recruits two obstacles prove to be particularly
        challenging. The probability of a recruit successfully negotiating the first of these is $\dfrac{1}{5}$
        and the probability of success at the second is $\dfrac{3}{8}$. By drawing a tree diagram and
        labelling the arms, what is the probability that a recruit will successfully pass both
        obstacles?   2

d)   The results of a series of tests were recorded.

        77, 72, 80, 77, 91, 62, 72, 82, 79, 58, 75, 67, 69, 66, 95, 81

      a)   What is the interquartile range for the data?   2

      b)   Draw a box-and-whisker plot for the data   2

      c)   Describe the skewness of the data.   1

Solutions Year 12 General Trial
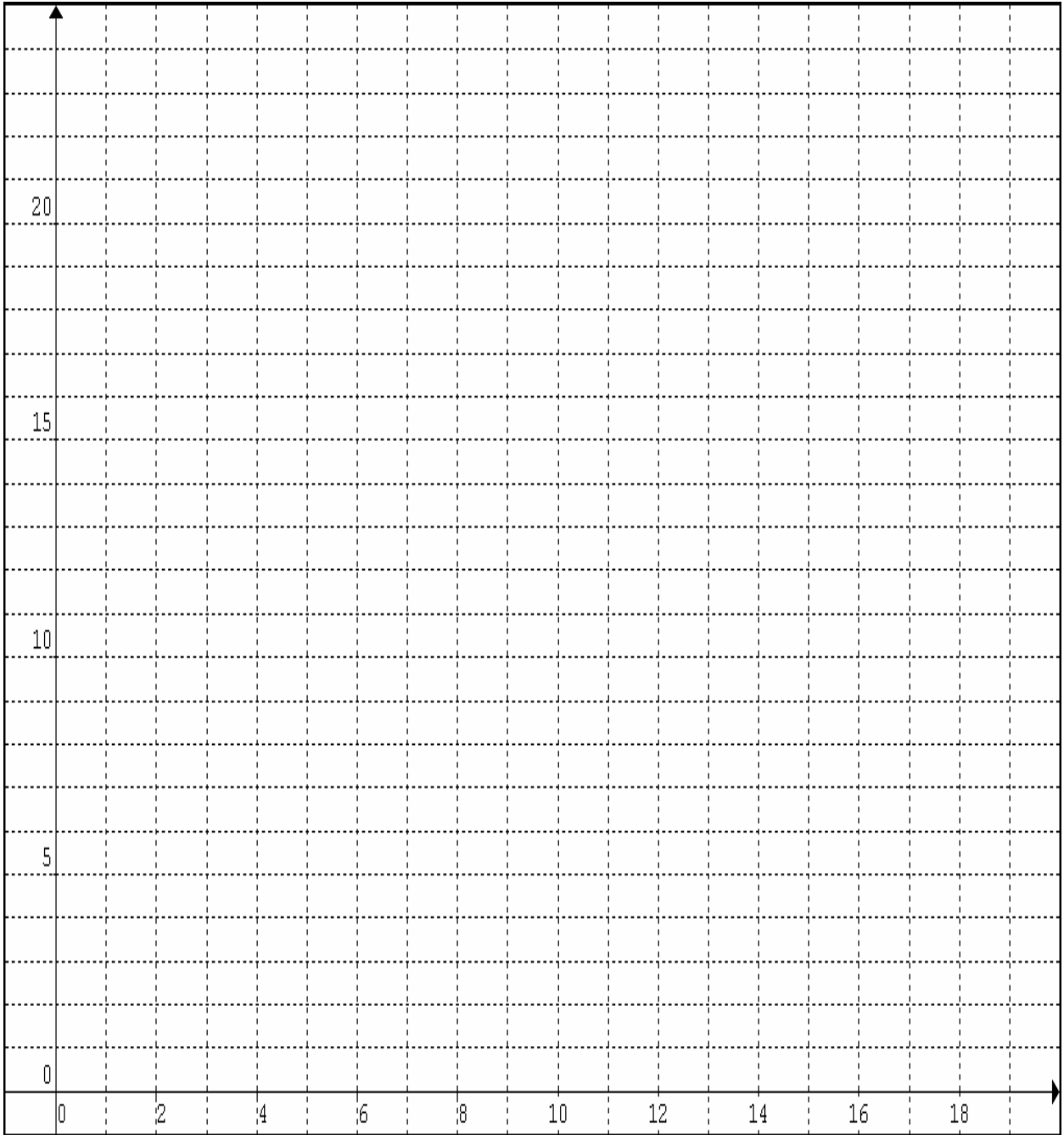
Section 1

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

Q23.

a) i) $V = \frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \pi \times (4.5)^2 \times 12$ ①

$= 254.469\ldots$

$= 254 \text{ cm}^3$ (to nearest cm³) ①

ii) $V = \pi r^2 h$

$254 = \pi \times 3^2 \times h$ ①

$h = \frac{254}{(\pi \times 3^2)}$

$h = 8.98$ ①

$h = 9 \text{ cm}$ (to nearest cm)

b) $V = \frac{4}{3}\pi r^3$

i) $V = \frac{4}{3} \times \pi \times 3^3$ ①

$= 113.1 \text{ cm}^3$ (to 1 dp)

ii) $V = \frac{4}{3}\pi r^3$

$3V = 4\pi r^3$

$r^3 = \frac{3V}{4\pi}$ (1/2)

$r = \sqrt[3]{\left(\frac{3V}{4\pi}\right)}$ (1/2)

iii) $V = \frac{4}{3}\pi r^3$

$34 = \frac{4}{3}\pi \times r^3$

$r^3 = \frac{3 \times 34}{(4\pi)}$

$r = \sqrt[3]{\left(\frac{3 \times 34}{4\pi}\right)}$ ①
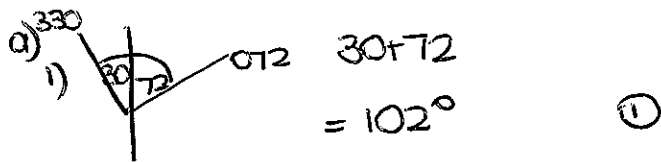
$= 2.00969\ldots$

$= 2.0 \text{ cm}$ (to 1 dp)

c) $16 \times 15 \times 14 = 3360$ ways ①

d) i) $A = \frac{h}{3}\{D_F + 4D_m + D_L\}$

$A = \frac{7}{3}\{12 + 4 \times 4 + 4\} + \frac{7}{3}\{4 + 4 \times 5 + 14\}$

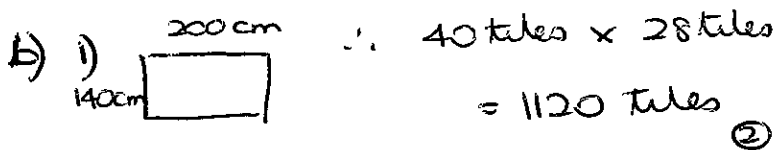$= \frac{224}{3} + \frac{266}{3}$

$= \frac{490}{3}$

$= 163\frac{1}{3}$ ②

ii) Cost $= 163\frac{1}{3} \times 12.50$

$= \$2041.67$ ①

e) $3(x+4) - 2(x-3) = 0$

$3x + 12 - 2x + 6 = 0$ ①

$x = -18$ ①

Q24.

a) i) 072 30+72

= 102° ①

i)

By Cosine Rule,
$x^2 = 95^2 + 100^2 - 2 \times 95 \times 100 \times \cos 102°$ ①

$x^2 = 22975.322...$

$x = \sqrt{22975.322...}$

$x = 151.576$

$x = 151.6m$ (to 1dp) ①

ii) Area $= \frac{1}{2} ab \sin C$

$= \frac{1}{2} \times 95 \times 100 \times \sin 102$ ①

$= 4646 \, m^2$ (nearest m^2). ①

b) i)   ∴ 40 tiles × 28 tiles
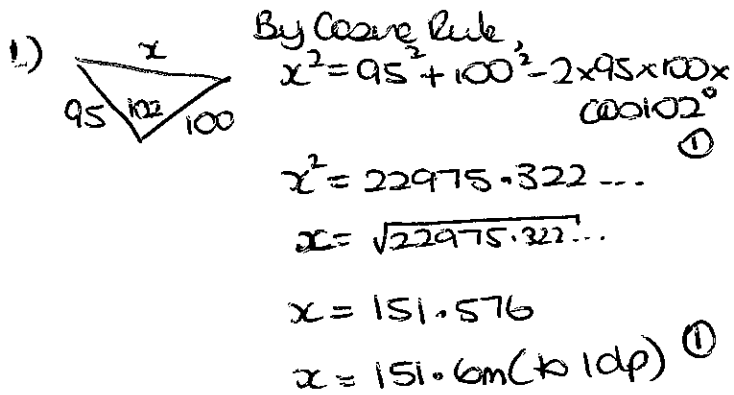
= 1120 Tiles ②

ii) no. of 10cm tiles   20 tiles × 14

= 280 tiles

I disagree with the suggestion.
you would require only 280 tiles
instead of 1120 tiles, which is
$\frac{1}{4}$ of original tiles needed.
Quantity required is related to
the area of the tile, not the
length. ②

c) i) 12 L / 100km   ①

ii) 8L / 100km ∴ for 50km it
would use 4L ①

d)

68%

95%

99.7%
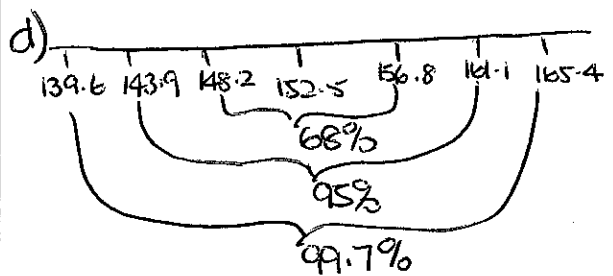
i) 148.2 to 156.8 ①

ii) 139.6 to 165.4 ①

Q25

a) i) $S \propto \frac{1}{T}$

$S = \frac{R}{T}$ ①

ii) $20 = \frac{R}{2.5}$

$R = 20 \times 2.5$

$R = 50$ ①

Equation $S = \frac{50}{T}$

iii) $10 = \frac{50}{T}$

$T = \frac{50}{10}$

$T = 5$ ①

iv) $S = \frac{50}{1.6}$

$S = 31.25$ ①

b) See graph paper

c) i) Old Clubs: $\bar{x} = 85.8$ $\sigma_n = 3.7$ ①

New Clubs: $\bar{x} = 81.3$ $\sigma_n = 2.6$ ①

ii) Yes as his mean decreased from
85.8 to 81.3 & his standard ①
iii) deviation is smaller which implies
his game became more consistent
(ie scores are more clustered) ②

Q26

a) i) $6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$ ways ①

ii) Number of ordered solution $= 6 \times 5 \times 4$
$= 120$

ways of organizing $3 = 3 \times 2 \times 1$
$= 6$

∴ No. combinations $= \dfrac{120}{6}$ ①
$= 20$ ways

iii) $P(S, L, P) = \dfrac{1}{20}$. ①

b) $1 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$ ①
$= 10,000,000$ numbers

c) i) Angle difference $= 10°$ ①
as $1° = 60$ n miles
$10° = 60 \times 10$
$= 600$ n miles ①

ii) 10.5 knots $1 \text{ knot} = 1 \text{nm/h}$
$S = \dfrac{D}{T}$
$10.5 = \dfrac{600}{T}$
$T = \dfrac{600}{10.5}$ ①
$= 57.14$ hours
$= 2.3809...$
$= 2$ days 9 hrs 8 mins 34.29sec ①
$= 2$ days 9 hrs (to nearest hr)

∴ arrives 10am 4th Dec $+ 2d$ $9h$
$= 7$pm 6th Dec ①

d) $r = 1\%$ pm $n = 4 \times 12$
$= 48$ mths ②

i) $= 0.01$ _____   _____
mistake 1   mistake 2.

ii) $A = 150 \left\{ \dfrac{(1 + 0.01)^{48} - 1}{0.01} \right\}$ ①
$= 150 \times 61.2226...$
$= \$9183.39$ ①

Q27. $D = 0.5 \times 10450$
$= \$1567.50$ ①

a) i) $S = V_0 - D_n$
$= 10450 - (1567.50 \times 6)$
$\$10450 - 9405$ ①
$= \$1045$

ii)
Book value $= 10450 - 1567.50 \times 2$
$= \$7315$ ①

b) i) Andrew performed better ①
as he is 1.8 standard deviation
above the mean whereas Robert
is 2.5 standard deviation below
the mean ①

ii) Andrew's mark z score $= \dfrac{rs - \bar{x}}{\sigma_n}$
$1.8 = \dfrac{rs - 65}{12}$
$rs = (1.8 \times 12) + 65$
$= 86.6$ ①
$= 87\%$
Robert's mark $=$ $-2.5 = \dfrac{rs - 65}{12}$
$rs = (-2.5 \times 12) + 65$
$= 35\%$ ①

c) i) $\$24.58 \times 20$

$= \$491.60$ ①

ii) Total $= \$491.60 \times 12 \times 5$

$= \$29\,496$ ①

iii) Interest $= 29\,496 -$
$\underline{20\,000}$
$\underline{\$9\,496}$ ①

iv) flat interest $= \dfrac{9496}{20\,000} \times \dfrac{100}{5}$

$= 9.496\%$ ②

Q28

a) i)

$I = 152.36 \times \dfrac{12.75}{100} \times \dfrac{21}{365}$

$= 1.117$

$= \$1.12$ ①

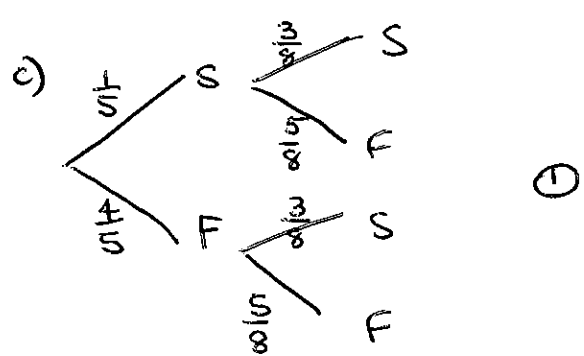ii) Total paid $= 152.36 + 1.12$

$= \$153.48$

$\% = \dfrac{1.12}{153.48} \times 100$ ①

$= 0.73\%$

b) $4.2\% \text{ pa} = 0.35\% \text{ pm} = 0.0035$

monthly $\overset{m}{\text{payment}} = \$615$ ①

20 yrs $= 240$ mths

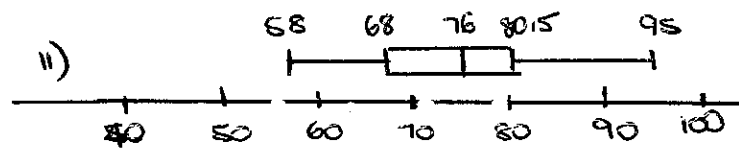$N = m\left[\dfrac{(1+r)^n - 1}{r(1+r)^n}\right]$ ①

$= 615\left[\dfrac{(1+0.0035)^{240} - 1}{0.0035(1+0.0035)^{240}}\right]$

$= 615 \times 162.187\ldots$ ①

$= 99745.2465\ldots$

$= \$99745$ (nearest $\$$) ①

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c)

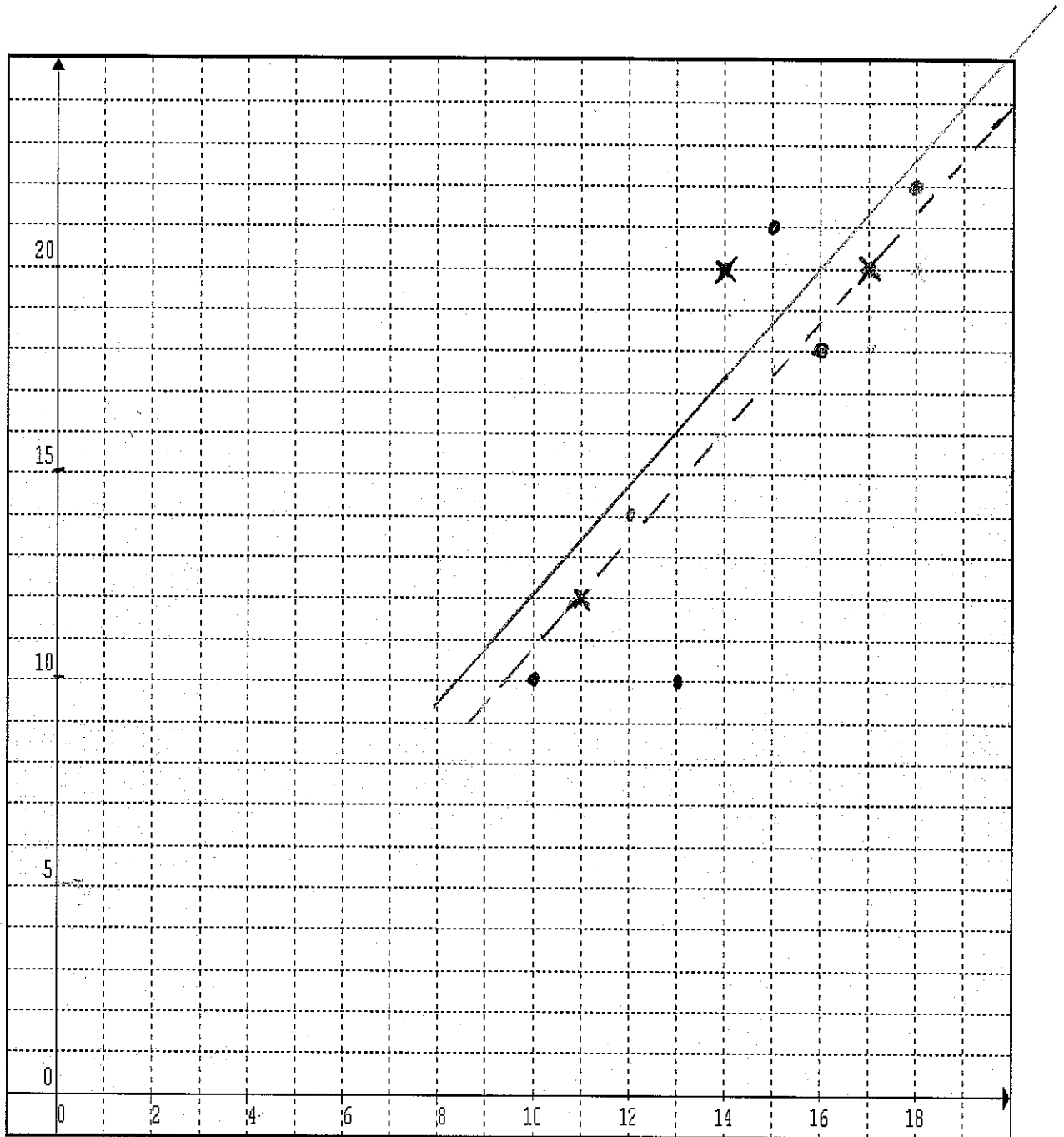$P(SS) = \dfrac{1}{5} \times \dfrac{3}{8}$ ①

$= \dfrac{3}{40}$

d) i) $Q_1 = 68$ $Q_2 = 76$ $Q_3 = 80.5$ ①

$\therefore IR = 80.5 - 68$

$= 12.5$ ①

ii)

iii) The data is negatively skewed. ①

Payment $

Length Paper (km)
route

① plotting
① 3 median
① dotted line
① final line

$-\frac{1}{2}$ no labels on axes