THE SCOTS COLLEGE

YR 12 PRETRIAL EXAMINATION - 2014
HIGHER SCHOOL CERTIFICATE

GENERAL MATHEMATICS

DATE: 26th March 2014

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using blue or black pen
- BOS Approved calculators may be used
- A separate multiple choice answer sheet is provided
- A separate formulae sheet is also provided

Total Marks – 80

Section I: Pages 2-7
20 marks

- Attempt questions 1-20, using the multiple choice answer sheet provided.
- Allow about 30 minutes for this section

Section II: Pages 8-15
60 marks

- Attempt questions 21-25, using all 5 writing booklets provided
- Allow about 1 hour 30 minutes for this section

Multiple Choice	Q21	Q22	Q23	Q24	Q25	Total
						/80

Section I

20 marks
Attempt Questions 1 to 20. (Allow about 30 minutes for this section)

Use the multiple-choice answer sheet for Questions 1-20.

1. Simplify $4(2y + 2) – 2 (y – 1)$

(A) $5y + 9$ **(B)** $2y + 15$

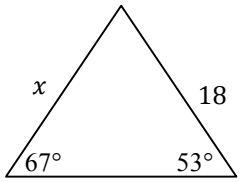
(C) $11y + 9$ **(D)** $6y + 10$

2. Use the formula $s = ut + \frac{1}{2} at^2$ to find the value of s when u = 7, t = 5 and a = 10

(A) 285 **(B)** 475

(C) 160 **(D)** 132

3. In this triangle, an expression for *x* is,



(A) $x = \frac{18\ sin\ 53°}{sin\ 67°}$ **(B)** $x = \frac{sin\ 53°}{18\ sin\ 67°}$ **(C)** $x = \frac{18\ sin\ 67°}{sin\ 53°}$ **(D)** $x = \frac{sin\ 67°}{18\ sin\ 53°}$

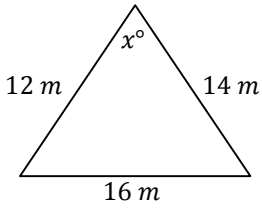
4. The percentage error of a measurement of 180g is;

(A) 2.8% **(B)** 0.27% **(C)** 0.028% **(D)** 0.28%

5. A survey looked at the eye colour of 100 Australians. Which term best describes the data?

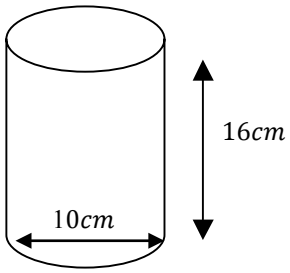
(A) Continuous **(B)** Stratified **(C)** Categorical **(D)** Discrete

6. Calculate the value of $\boldsymbol{x}$ in the diagram below.



(A) 25° **(B)** 47° **(C)** 76° **(D)** 58°

7. Calculate the surface area of the closed cylinder to the nearest square cm



(A) 581cm^2 **(B)** 660cm^2 **(C)** 1257cm^2 **(D)** 1634cm^2

8. Simplify $4x^2 \times \frac{10y}{2x}$

(A) 20xy **(B)** 6xy

(C) 12x^2y **(D)** $\frac{\mathbf{12x^2y}}{\mathbf{2}}$

9. Make h the subject of the following formula;

$$\boldsymbol{V = \frac{1}{3}\pi r^2 h}$$

(A) h = $\sqrt{\frac{3v}{\pi r}}$ **(B)** h = $\frac{3V}{\pi r^2}$

(C) h = $\frac{V\pi r^2}{3}$ **(D)** h = $\frac{3V}{\sqrt{\pi r}}$

10. A set of scores are displayed in a stem and leaf plot. What is the median of these scores?

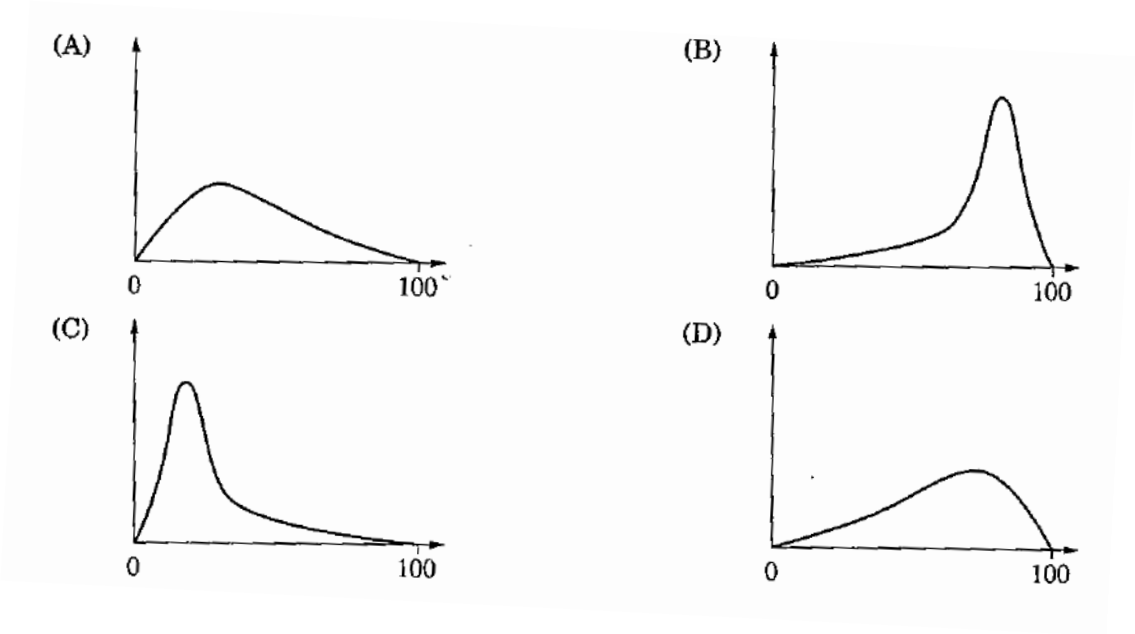
1	2	3	4
2	5	6	
3	8	9	
4	1	3	7

(A) 32 **(B)** 28 **(C)** 31 **(D)** 30

11. The mean of a set of 6 scores is 62. What is the new mean of the set of scores after a score of 20 is added?

(A) 55 **(B)** 56 **(C)** 54 **(D)** 62

12. Which of the following graphs represents positively skewed data with the smallest standard deviation?



13. Tom borrows $420 000 to buy a property. Interest is charged at 7.2 % p.a. compounded monthly. How much does Tom owe at the end of the first month, after he has made a $4000.00 repayment?

(A) $446 240 **(B)** $445 952 **(C)** $418 520 **(D)** $418 496

14. The following table is used to calculate Phil's tax payable

Taxable Income	*Tax payable*
$0 - $20 000	Nil
$20 001 - $45 000	Nil plus 10c for each $1 over $20 000
$45 001 - $70 000	$2500 plus 35cents for each $1 over $45 000
$70 001 and above	$11 250 plus 52 cents for each $1 over $70 000

Phil's taxable income is $ 80 000.
Assuming he has no deductions,calculate his tax payable.

(A) $16 320 **(B)** $15 970 **(C)** $13 125 **(D)** $16 450

15. Find the dividend yield at 8% of 4500 shares with a current market value of $11.40

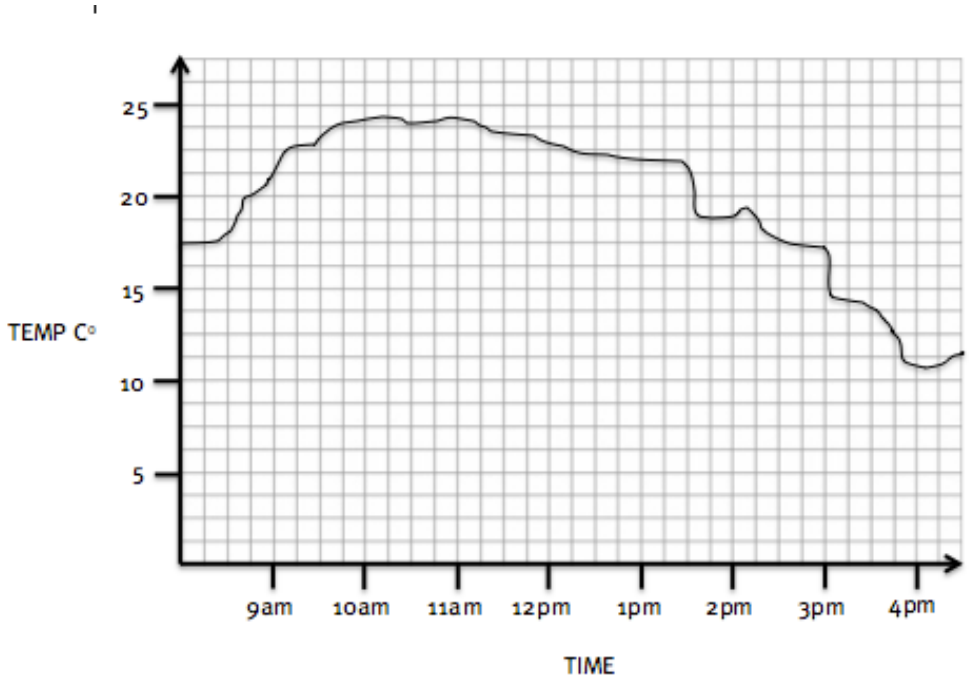
(A) $4104 **(B)** $4100 **(C)** $3799 **(D)** $3999

16. Jack wants to put a deposit of $20 000 on a house in 5 years. How much does he need to deposit in the bank now if the interest rate is 7% compounding annually.

(A) $14 356.29 **(B)** $14 259.72

(C) $13 989.00 **(D)** $14 756.77

17. The graph shows the change in temperature on a day. The temperature at 9:00am was approximately



(A) 23° **(B)** 21° **(C)** 25° **(D)** 20°

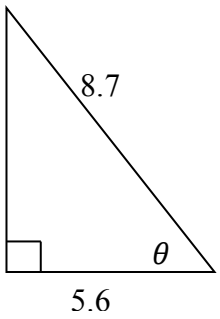
18. The following data shows the results of a maths test out of 10.

5, 8, 3, 6, 7, 5, 9, 6, 7

The mode of this data is;

(A) 7 **(B)** 7,5 **(C)** 7,5,6,3 **(D)** 7,5,6

19. Evaluate θ to the nearest minute;



(A) 49° **(B)** 49°57′ **(C)** 50° **(D)** 49°56′

20. Martin buys a car for \$19 950 and sells it for \$22 500. What is his profit as a percentage of the cost price?

(A) 12.5% **(B)** 11.7% **(C)** 11% **(D)** 12.8%

End of Section I

Section II

Marks

60 marks

Attempt Questions 21–25. Allow about 1 hour 30 minutes for this section.

Answer each question in a separate writing booklet.

Question 21 (12 marks) Start a new writing booklet.

(a) Simplify the following expressions:

(i) $\frac{2ab^2}{4a^2b}$ **1**

(ii) $\frac{a^2}{2a} \div a$ **1**

(b) Evaluate $3x^2 + \sqrt{x}$ correct to 3 significant figures, when $x = 4.5$ **2**

(c) Using the formula $T = 2\pi\sqrt{\frac{l}{g}}$ find l correct to 1 decimal place, when $T = 80$ and $g = 5$ **2**

(d) A light year is the distance light travels in 1 year. Find the speed of light in km per hour if a light year is 9.46×10^{12} km. (Write your answer in scientific notation correct to 3 significant figures) **2**

(e) Solve $\sqrt{2x} = 4$ **2**

(f) Julian borrows $10,000 at 15% p.a. flat rate of interest over 5 years. Calculate the amount of each equal monthly instalment. **2**

End of Question 21

Question 22 (12 marks) Start a new writing booklet.

Marks

(a) The number of years that people have been living overseas (i.e. away from their birth country) is shown in the data below;

America:

3 3 4 4 4 5 5 7 7 8 8 10

England:

4 4 5 5 5 6 7 8 8 9 11 11 11

(i) Draw a box and whisker plot for these 2 sets of data on the same axes **4**

(ii) Comment on the spread and skewness between the 2 sets of data. Justify your answer. **2**

(b) When children started school they were tested to see if they could swim. The results appear in the 2 way table below.

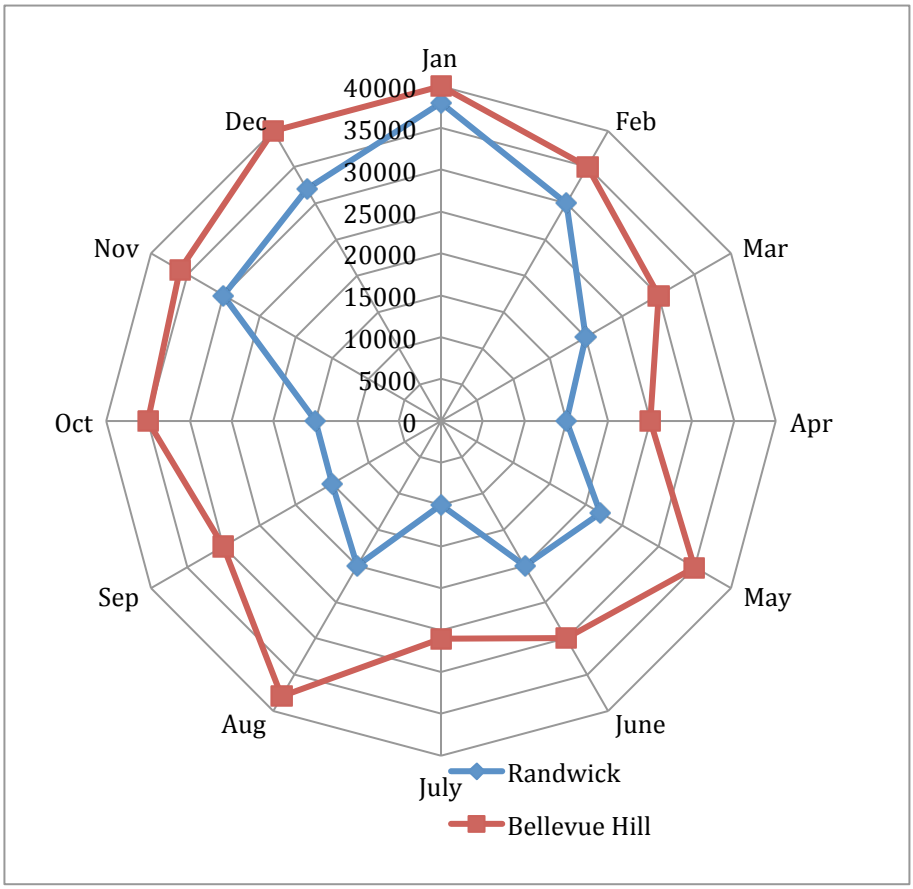
	Swim	Cannot swim	Totals
Boys	95	14	109
Girls	106	18	124

(i) What percentage of boys cannot swim? **1**

(ii) What percentage of the children who cannot swim are girls? **1**

Question 22 is continued on the next page.

(c) Tobias runs a newsagency at Randwick and Aiden runs another at Bellevue Hill. The monthly sales figures are shown in the radar chart below.



(i) What were the sales at Randwick in December? **1**

(ii) What were the sales at Bellevue Hill in January? **1**

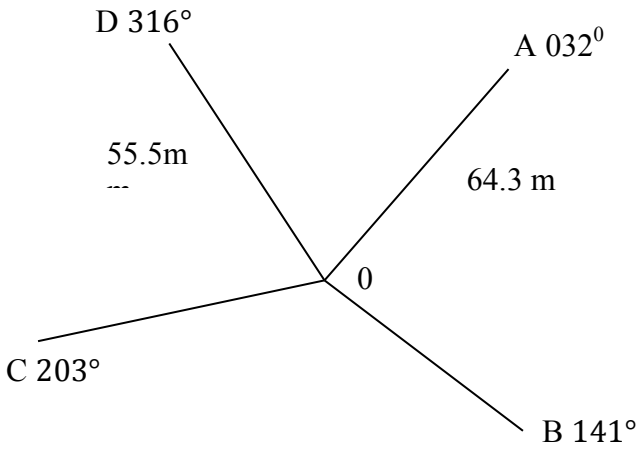
(d) Sean purchased a camera for $880.00 while on holidays in Los Angeles. The price included 10% GST. When he left Los Angeles he received a refund for the GST. Calculate Sean's refund. **2**

End of Question 22

Question 23 (12 marks) Start a new writing booklet.

Marks

(a) (i) Calculate the size of ∠ DOA **1**



(ii) Calculate the area of triangle DOA. Give your answer correct to 1 decimal place. **1**

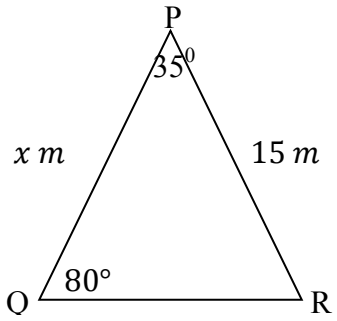
(b) From the notebook entries, distances are in metres

	B	
	50	
D20	30	
	20	**20C**
	0	
	A	

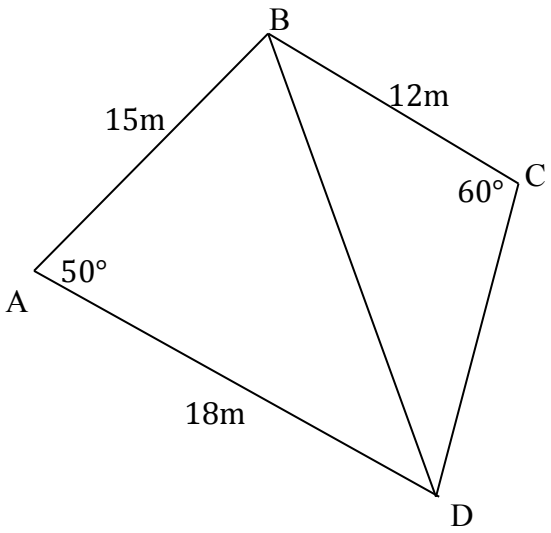
(i) Draw a sketch of the field, showing all measurements **1**

(ii) Calculate the area of the field. **2**

(c) Find the length of the side marked *x*. Give your answer to the nearest metre. **2**



(d) In the diagram below, ABCD is a quadrilateral in which AB = 15m, BC = 12cm, AD = 18m, ∠BAD = 50° , and ∠BCD = 60^0



(i) Find the length of BD correct to I decimal point. **2**

(ii) Find the size of ∠ BDC correct to the nearest degree. **2**

(e) Solve 4 (3y – 2) = 10y + 8 **1**

End of Question 23

Question 24 (12 marks) Start a new writing booklet.

Marks

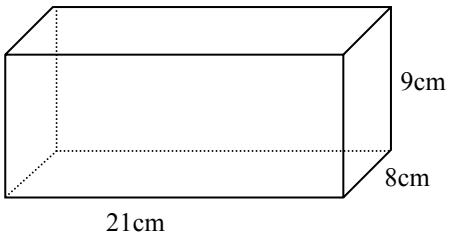
(a) The weight of boxes of Weetbix cereals are **normally distributed**. The mean of each box is 648g and the standard deviation is 2 g. The labelled weight of a box of Weetbix is 650g.

(i) Calculate the z score of a box of Weetbix weighing 650g. **1**

(ii) Weetbix boxes are labelled as having a weight of 650g. What percentage of boxes will have a weight of less than 650g? **3**

(b) A brick is made in the shape of a rectangular prism with dimensions as shown.

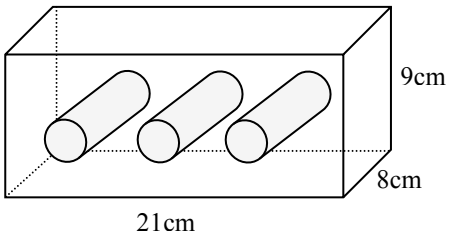
NOT TO SCALE



(i) Calculate the volume of the brick. **1**

(ii) What is the volume of clay remaining in the brick after 3 cylindrical holes have been made? Each hole has a radius of 1.4cm. Give your answer to the nearest cubic centimetre. **2**

NOT TO SCALE



(iii) What percentage of clay is removed by making the holes through the brick? (Answer to 1 d.p) **2**

(c) The Smith's need to install a new shower head,which saves 5 litres of water per minute. The shower is used 4 times per day for 5 minutes each time. **2**

If the charge for water is $1.015 per kilolitre, how much money would be saved in 1 year by using the new shower head. (Assume there are 365 days in 1 year)

(d) Simplify $\frac{5x}{3} - 2(4x - 6) = 0$ **1**

End of Question 24

Question 25 (12 marks) Start a new writing booklet.

Marks

(a) The table below is used to calculate the monthly loan repayments. If Chris borrowed $70 000 at 8% p.a. for 15 years, what is his monthly loan repayment? **1**

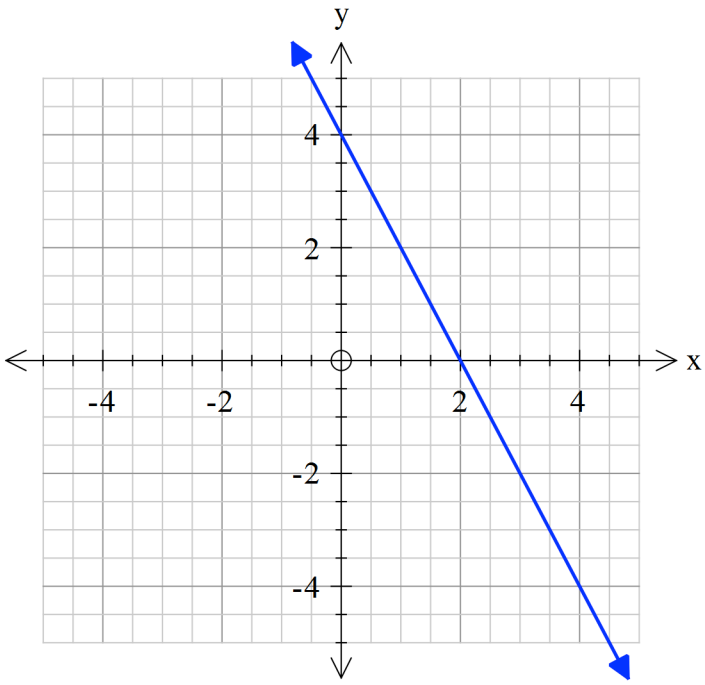
Monthly Loan Repayments (in dollars) per $1000 borrowed

Interest Rate % pa	5 years	10 years	15 years	20 years
5%	18.87	10.61	7.91	6.60
6%	19.33	11.10	8.44	7.16
7%	19.80	11.61	8.99	7.75
8%	20.28	12.13	9.56	8.36
9%	20.76	12.67	10.14	9.00

(b) A surveyor takes five measurements of the same pond at equal intervals, tabulates the results which are shown below and uses Simpson's Rule to find the approximate area of the pond. Calculate the area of the pond. (Hint: Draw a diagram) **2**

Distance from left boundary, x (m)	0	5	10	15	20
Measurements, y (m)	4	15	12	18	8

(c) Using the graph below;



(i) What is the gradient of the line? **1**

(ii) What is the equation of the line? **1**

(d) In the 2000 HSC, General Mathematics had a mean of 62.5 and a standard deviation of 1.5, while in the following year the mean was 58.5 and the standard deviation 4.0. Chris sat the HSC in 2000 and Elliot 2001.

(i) Calculate the z score for Chris if his mark in Maths was 66. **1**

(ii) Calculate the z score for Elliot if his mark in Maths was 66. **1**

(iii) Which student performed better? Explain your answer. **1**

(e) A plane flies from Melbourne for 200km on a bearing of 040°, it then changes course and continues flying on a bearing of 157^0 for 345km.

(i) How far from Melbourne is the plane to the nearest km? **2**

(iii) What is the bearing of the plane to Melbourne. Give your answer to the nearest degree. **2**

End of Section II
End of Examination

THE SCOTS COLLEGE – MATHEMATICS DEPARTMENT
2014 GENERAL MATHEMATICS PRE-TRIAL HSC

CANDIDATE NUMBER:_____ TEACHER: Solns.

SECTION I – MULTIPLE CHOICE ANSWER SHEET (20 MARKS)
Mark the correct answer by filling in the circle. To make a correction, neatly place a cross over the circle and then fill in the correct circle.

EXAMPLE:

A	B	C	D
○	⊗	●	○

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

M/C - everyone
Qu 21 - PNG
22 - FER
23 - BRN
24 - STEL
25a+b - FER
25c+d - BRN
25e - STEL

Solns Section B Yr 12 Pre-trial.

21ai) $\frac{2ab^2}{4a^2b} = \frac{b}{2a}$ (1)

(ii) $\frac{a^2}{2a} \div a = \frac{a}{2} \times \frac{1}{a}$ (1)

$= \frac{1}{2}$

(b) $3x^2 + \sqrt{x} = 3 \times (4.5)^2 + \sqrt{4.5}$ (1)

$= 62.9$

(1)

(c) $T = 2\pi\sqrt{\frac{L}{g}}$

$80 = 2\pi \times \sqrt{\frac{L}{5}}$

$\frac{80}{2\pi} = \sqrt{\frac{L}{5}}$

$12.732... = \sqrt{\frac{L}{5}}$ (1) working

$162.1138... = \frac{L}{5}$

$810.6\text{h} = L$ (1)

6

2d) $\frac{9.46 \times 10^{12}}{365} \div 24$

$= 107\,99086\,76$ ① working

$= 1.08 \times 10^{9}$ km/hr ① answer.

(e) $2x = 16.$ ①

$x = 8$ ①

(f) $I = 10,000 \times 0.15 \times 5$

$= 7500$

Total amount $= 17500$ ① working

monthly payment $= \frac{17500}{(5 \times 12)}$ ① answer.

$= \$291.67$

(22) America: 3, 3, 4, 4, 4, 5, 5, 7, 7, 8, 8, 10

median = 5 min = 3

$Q_1 = 4$ max = 10

$Q_3 = 7\frac{1}{2}$

① for all correct values ie. median Q_1 & Q_3

England: 4, 4, 5, 5, 5, 7, 8, 8, 9, 11, 11, 11

min = 4

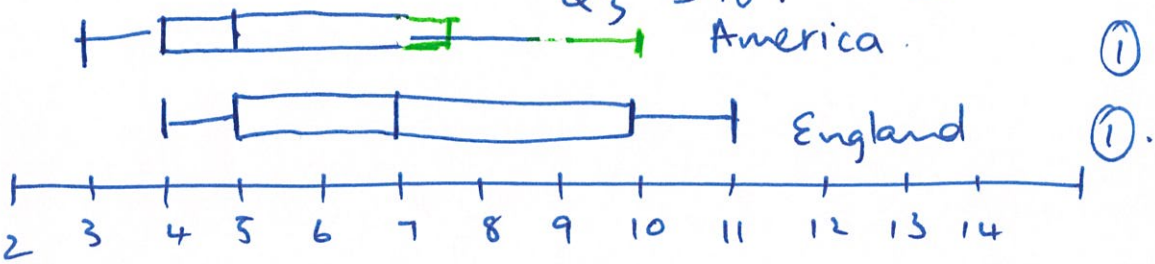
max = 11

median = 7

$Q_1 = 5$

$Q_3 = 10$.

① for all correct values as above.



① ①.

(ii) The spread of the American scores is +vely skewed as the top 25% & the top 50% are spread out. The spread of the English data is approx. symmetrical as the spread of the top 25% & the both 25% & the top 50% & bottom 50% is approx. equal.

② for a coherent / succint response.

bi) $\frac{14}{109} \times 100\% = 12.8\%$ ①

(ii) $\frac{18}{32} \times 100\% = 56.25\%$. ①

(c) (i) 32000 (1)

(ii) 40,000 (1).

(d) $\frac{880}{11} = \$80$ (1) working

(1) answer.

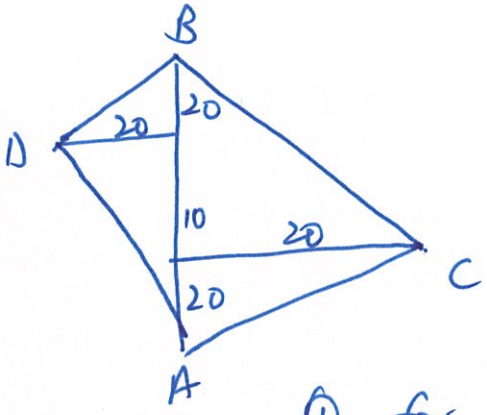
23a(i) $\angle DOA = 76^\circ$ (1)

(ii) $A = \frac{1}{2}ab\sin O$

$= \frac{1}{2} \times 55.5 \times 64.3 \times \sin 76^\circ$

$= 1731.3\ m^2$ (1)

(b)



(1) for correct diagram

Total area $= A_1 + A_2$

$= \frac{1}{2}bh + \frac{1}{2}bh$

$= \left(\frac{1}{2} \times 50 \times 20\right) \times 2$.

$= 1000\ km^2$

(1) working

(1) answer.

(c) $\frac{r}{\sin R} = \frac{O}{\sin O}$

$\frac{x}{65} = \frac{15}{\sin 80}$

(1) working

$x = \frac{15 \sin 65}{\sin 80}$

(1) answer.

$= 14m$

(di) $a^2 = b^2 + d^2 - 2bd \cos A$

$= 18^2 + 15^2 - 2 \times 18 \times 15 \times \cos 50$

$= 549 - 347.105309 2 \ldots$

$= 201.89 \ldots$ ① working

$\therefore BD = 14.2$ m. ① answer.

(ii) $\frac{\sin \theta}{12} = \frac{\sin 60}{14.2}$ ① working

$\theta = 47^\circ$ ① answer.

(e) $4(3y - 2) = 10y + 8$

$12y - 8 = 10y + 8$

$y = 8$ ①.

24a(i) $\bar{x} = 648 \quad SD = 2$

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

$$= \frac{650 - 648}{2}$$

$$= 1$$ (1)

(ii) $50\% + 34\% = 84\%$ (1) working & (1) answer.
(for both correct %'ages)

(b)(i) $Vol = lbh$

$= 21 \times 8 \times 9$

$= 1512\ cm^3$ (1).

(ii) Total vol. of 3 holes $= 3 \times \pi \times 1.4^2 \times 8$

$= 147.780\ldots$ (1).

Vol. of clay remaining $= 1512 - 147.780\ldots$

$\doteq 1364\ cm^2$ (1).

(iii) % of clay removed

$$= \frac{147.7805}{1512} \times 100\%$$

$= 9.8\%$

(1) working
(1) answer.

(ii) H_2O savings $= (5 \times 4 \times 5 \times 365) \div 1000$

$= 36.5$ kL/yr (1)

Money saved $= 36.5 \times 1.015$

$= \$37.05$ (1).

(iii) $\frac{5x}{3} - 2(4x - 6) = 0$

$5x - 6(4x - 6) = 0$

$5x - 24x + 36 = 0.$ (½ working)

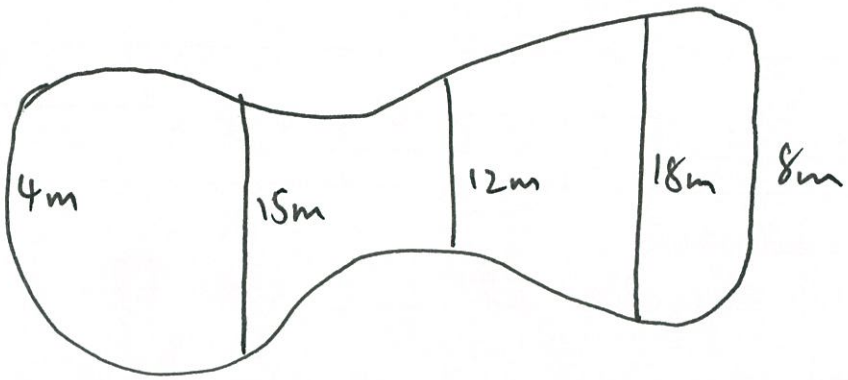
$-19x = -36$

$x = 1\frac{17}{19}$ (½ working).

25a) $\frac{70\,000}{1000} = 70 \times 9.56$ ~~8.99~~

$= \$629.30$ ~~$\$699.20$~~ (1)

(b)



Use Simpson's rule twice

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

$\doteq \frac{5}{3}(4 + 4\times 15 + 12)$

$\doteq 126.666\ldots\ m^2$ ($\frac{1}{2}$)

$A \doteq \frac{5}{3}(12 + 4\times 18 + 8)$

$\doteq 153.333\ldots\ m^2$ ($\frac{1}{2}$)

$\therefore$ Total area $= 126.666 + 153.333$

$\doteq 280\ m^2$ (1)

(c) (i) $m = \frac{-4}{2}$

$= -2$ (1)

(ii) $y = -2x + 4$.

(d)(i) $\frac{66 - 62.5}{1.5} = 2.3$ - Chris

(1)

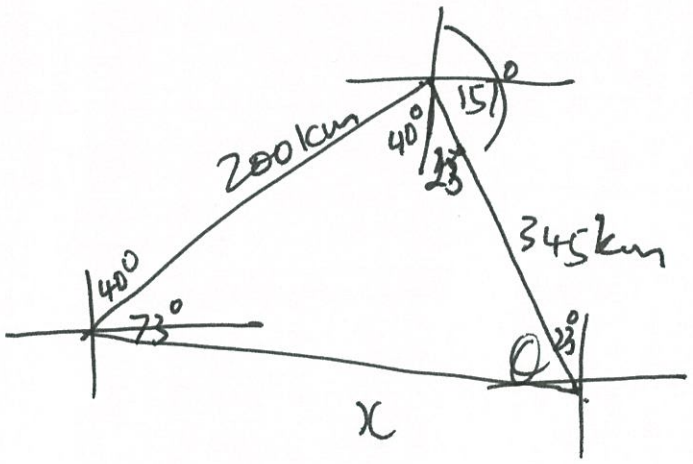
(ii) $\frac{66 - 58.5}{4} = 1.875$ - Elliot.

(1)

Chris has a higher z-score,

∴ he performed better than Elliot (1)

(e)



(i) $x^2 = 200^2 + 345^2 - 2 \times 200 \times 345 \cos 63^\circ$

$= 37974.31104....$

$x = 193.3243$

$= 193$ km

(1) working

(1) answer.

(ii)

$\frac{\sin\theta}{200} = \frac{\sin 63}{310}$

$\sin\theta = \frac{\sin 63}{310} \times 200$

$\theta = 35^\circ$