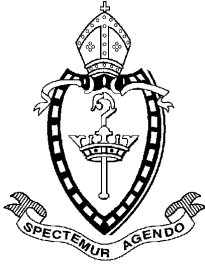


NEWCASTLE GRAMMAR SCHOOL

Student Number: _____



2011 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

General Mathematics

Examination Date: 17th August 2011

Weighting: 40%

Examiner: Mrs N. Robertson

General Instructions

- Reading Time - 5 minutes
- Working Time - 2½ hours
- Write using a blue or black pen
- Write your student number on every booklet
- Calculators may be used
- A formulae sheet is provided at the back of this paper

Total Marks: 100

Section I pages 2 – 6

22 marks

- Attempt Questions 1 - 22
- Answer on the Multiple Choice answer booklet provided
- Allow about 30 minutes for this section

Section II pages 7 - 14

78 marks

- Attempt Questions 23 – 28
- Answer in the booklets provided. Start a new booklet for each question
- Allow about 2 hours for this section

SECTION I

Total Marks (22)

Attempt Question 1 – 22

Allow about 30 minutes for this section

Select the alternative A, B, C or D that best answers the question.
Circle your answer on the multiple-choice answer sheet provided.

1. Tamara picks mushrooms and is paid \$2.15 per box. Her pay for picking 53 boxes is:

- A. \$113.95 B. \$53 C. \$24.65 D. \$14.05
-

2. Brittany's garden hose can fill a 5 litre bucket in 10 seconds.

When expressed as the rate of flow in litres per hour, this is the same as:

- A. 180 L/hr B. 1800 L/hr C. 30 L/hr D. 200 L/hr
-

3. Which **one** of the following statements is **NOT** true:

- A. A dot plot is convenient for illustrating small sets of data
B. A dot plot can be used directly with unsorted data
C. A dot plot is very time consuming for large sets of data
D. A dot plot is convenient for illustrating large sets of data
-

4. The volume of a sphere with diameter 15 cm is closest to:

- A. $14\,137\text{ cm}^3$ B. $14\,138\text{ cm}^3$ C. 1767 cm^3 D. 1768 cm^3
-

5. Lani has a box full of marbles and uses the capture-recapture technique to estimate how many marbles are in the box.

Lani removes a random sample of 100 marbles from the box, tags them with a permanent marker and returns them to the box. She then mixes up all the marbles before taking another random sample of 80 marbles from the box. Of these 80 marbles, she finds 5 of them are tagged.

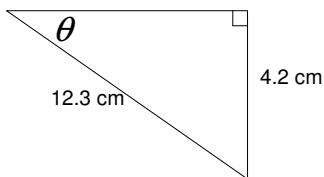
The number of marbles in Lani's box is approximately:

- A. 160 B. 400 C. 500 D. 1600
-

6. If E is the event “a number less than 3” when a die is rolled, then the complement of the event, \tilde{E} , equals:

- A. $\{1, 2, 3\}$ B. $\{3, 4, 5, 6\}$ C. $\{4, 5, 6\}$ D. $\{1, 2, 3, 4\}$
-

7. Which one of the following equations would be used to find the size of the angle θ in the following triangle?



- A. $\sin \theta = \frac{4.2}{12.3}$ B. $\tan \theta = \frac{4.2}{12.3}$ C. $\cos \theta = \frac{4.2}{12.3}$ D. $\cos \theta = \frac{12.3}{4.2}$
-

8. Hamish borrows \$5 600 to set up his ‘digs’ at University. The simple interest rate is 10.75% p.a. for three years.

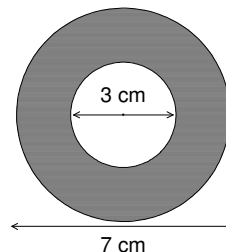
His monthly repayment is:

- A. \$50.17 B. \$172.28 C. \$205.72 D. \$2468.67
-

9. The upper and lower limit for a measurement of 23.6 cm is:

- A. 23–24 cm B. 22.6–24.6 cm C. 23.5–23.7 cm D. 23.55–23.65 cm
-

10. The correct expression to calculate the area of the annulus is:



- A. $\pi \left(\left(\frac{7}{2} \right) - \left(\frac{3}{2} \right) \right)^2$ B. $\pi \left(\left(\frac{7}{2} \right)^2 - \left(\frac{3}{2} \right)^2 \right)$ C. $\pi(7^2 - 3^2)$ D. $\pi(7 - 3)^2$
-

11. Make v the subject of the formula $E = \frac{1}{2}mv^2$.

- A. $v = \pm \sqrt{\frac{2E}{m}}$ B. $v^2 = \frac{2E}{m}$ C. $\frac{1}{2}mv^2 = E$ D. $m = \frac{2E}{v^2}$
-

12. Lauren receives a gross pay of \$35 866, has tax deductions of \$6874, medical fund fees of \$425 and superannuation of \$1240. Her net pay is:

- A. \$28 992 B. \$27 327 C. \$44 405 D. \$30 657
-

13. The interquartile range of the following set of scores is:

5 5 6 7 7 7 8 8 9

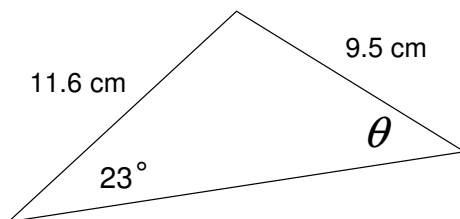
- A. 2 B. 2.5 C. 3 D. 4
-

14. The sample standard deviation of the scores in the table below is:

Class	Frequency
7	3
12	7
17	8
22	4
27	5

- A. 17.19 B. 6.31 C. 6.43 D. 4
-

15. Refer to the diagram.



The correct expression to calculate the angle θ is:

- A. $\tan \theta = \frac{11.6}{9.5}$ B. $\cos \theta = \frac{9.5}{11.6}$ C. $\sin \theta = \frac{11.6 \sin 23}{9.5}$ D. $\sin \theta = \frac{9.5 \sin 23}{11.6}$
-

16. Joel tested the statement “that there is a one in four chance of guessing the correct answer on a multiple choice paper with four alternative answers” by “guessing” the first four answers on a test.

The probability of Joel correctly guessing the first three answers and getting the fourth answer wrong can be determined by which one of the following expressions:

- A. $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{3}{4}$ B. $\frac{1}{4} \times \frac{1}{4} \times \frac{1}{4} \times \frac{3}{4}$ C. $\frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{1}{4}$ D. $\frac{1}{4} \times \frac{1}{4} \times \frac{1}{4} \times \frac{1}{4}$
-

-
17. In a recent General Mathematics test at *Robertson Senior College* the mean score was 65 and the standard deviation was 15.

The examination mark that corresponded to a z -score of 1.4 is:

- A. 86 B. 79 C. 80 D. 66.4
-

18. In the process of setting up “May’s A-May-zing Munchies” Cafe, Ruth purchased a new industrial oven for \$11 400.

For taxation purposes Ruth used the straight-line method of depreciation to depreciate the oven by \$2150 each year. The book value after 4 years is:

- A. \$2 800 B. \$4 950 C. \$7 100 D. \$9 250
-

19. Matthew is having a well-earned holiday at a resort situated at (12°N, 25°W) while Samantha is preparing to board a yacht situated at (10°S, 30°W).

Based on these two locations, which one of the following statements is accurate:

- A. Samantha is 22° South and 5° West of Matthew
B. Samantha is 22° South and 5° East of Matthew
C. Samantha is 22° North and 5° West of Matthew
D. Samantha is 22° North and 5° East of Matthew
-

20. Simplify $\frac{x}{8-x} \times \frac{3(x-8)}{5}$

- A. $15x$ B. $-15x$ C. $\frac{3x}{5}$ D. $\frac{-3x}{5}$
-

21. As part of a research project, Imogen randomly selected 200 results from a database of blood tests for glandular fever. The results indicated that some of the people were suffering from the disease and some were not. She recorded her findings in a two-way table as shown:

	Test Results		
	Accurate	Not Accurate	Total
Number with disease	22	4	26
Number without disease	168	6	174
Total	190	10	200

The percentage of those who had a positive test and actually had glandular fever is:

- A. 11% B. 11.6% C. 78.6% D. 84.6%
-

22. Which one of the following equations represents exponential decay?

- A. $y = (0.56)^x$ B. $y = (0.56)x^2$ C. $y = \frac{(0.56)}{x}$ D. $y = (1.56)^x$

End of Section I

Section II

Total Marks (78)

Attempt Questions 23 - 28

Allow about 2 hours for this section.

Answer all questions, **starting each question in a new booklet** with your number and question number at the top of the page.

All necessary working should be shown in every question.

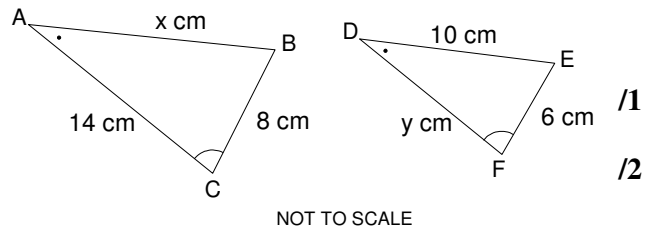
Question 23 (13 marks) **Start a new booklet.**

- a. Georgia's General Store added 15% to every item sold. What price tag would be on an item originally costing \$356?

/1

- b. In the following pair of similar figures find:

- i. the scale factor
ii. the length of the two unknown sides.



/1

/2

- c. Expand and simplify $4(x + 3) - 5(2 - x)$

/2

- d. The current conversion rate for Australian dollars (\$A) into American dollars (\$US) is approximately 1.06 \$US/\$A, (ie \$A1 = \$US1.06)

- i. How many US dollars would Damien receive for \$A2750?
ii. How many Australian dollars would Damien receive for \$US1300?

/1

/1

- e. During the end of financial year sales, Hetherington Homemaker's sold laptops and televisions in the ratio 3 : 2 and televisions and mobile phones in the ratio 1 : 4.

If 72 mobile phones were sold during their sales, how many laptops were sold?

/2

- f. The prices of houses sold by Lee's Real Estate in one month were as follows:

\$255 000 \$315 000 \$480 000 \$270 000 \$280 000

- i. Lee's Real Estate claimed that, for this month, the "average" price of houses was \$320 000. **Show** by calculation which "average" (mean, median or mode) Lee's Real Estate used.
ii. Is this an appropriate "average" to use? Justify your answer using correct mathematical terminology and with reference to each of the other measures of central tendency.

/1

/2

End of Question 23

Question 24 (13 marks) **Start a new booklet.**

All necessary working should be shown in every question.

a. Calculate $\sqrt[3]{5.67 \times 10^{-4}}$, giving the answer in standard notation, correct to 3 significant figures. /2

b. Mitchell purchased \$10 000 worth of shares in January 2010. During the first 12 months they increased in value by 15%. However, due to the economic downturn, they have now decreased in value by 8%.

What is the current value of his shares?

/2

c. Mirren uses the following information to assist with calculating her taxable income for the 2010-2011 financial year: salary \$67 220, interest earned \$985, uniform allowance \$612, working in dangerous conditions allowance \$5 000, tax agent fee \$180, use of car for business \$1 255, union fees \$600.

Australian income tax rates for the 2010-2011 tax year:

Taxable Income	Tax on this income
\$0-\$6,000	Nil
\$6,000-\$37,000	15c for each \$1 over \$6,000
\$37,000-\$80,000	\$4,650 plus 30c for each \$1 over \$37,000
\$80,000-\$180,000	\$17,550 plus 37c for each \$1 over \$80,000
Over \$180,000	\$54,550 plus 45c for each \$1 over \$180,000

i. **Show** by working that Mirren's taxable income is \$71 782.

/1

ii. The Medicare levy is 1.5% of taxable income. Hence, calculate Mirren's Medicare levy for the 2010-2011 financial year.

/1

iii. Using the **Australian income tax rates for 2010-2011**, and the Medicare levy (**part ii**), calculate the total amount of tax payable.

/2

iv. Throughout the year Mirren's employer has deducted a total of \$30 249.90 in PAYG tax from her salary. Does Mirren owe the Australian Tax Office more money or does she receive a refund? Justify your answer by working and stating the final amount.

/1

d. The **Harris & Marks'** Health Centre employs 7 managers plus 16 staff. During each shift the centre stipulates that 2 managers and 6 staff are to be on duty.

i. How many different groups of 2 managers and 6 staff are possible for a particular shift?

/2

ii. Shaun is a manager and his best mate Luke is a staff member. What is the probability that **neither** of them is rostered on to work a particular shift?

/2

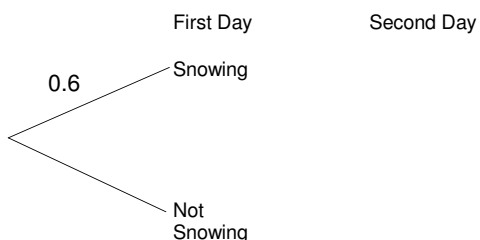
End of Question 24

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

All necessary working should be shown in every question.

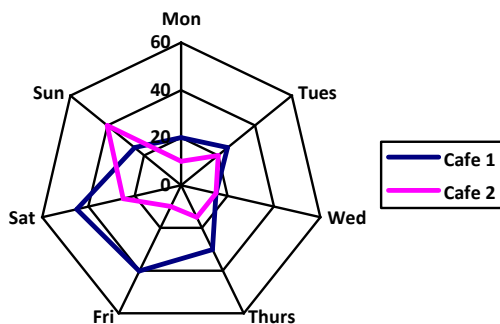
- a. Michael took out a loan for \$12 000 at 6% p.a., compounding monthly, repayable over 4 years with equal monthly repayments.
- i. **Show** by working that the monthly rate of interest is 0.005. /1
 - ii. What is the size of Michael’s monthly loan repayment? /2
 - iii. Calculate the total amount he will repay over the 4 year period. /1

- b. Chelsea is spending two days skiing. The weather forecast predicted that the probability of it snowing on the first day was 0.6 and the probability of it snowing on the second day was 0.9.



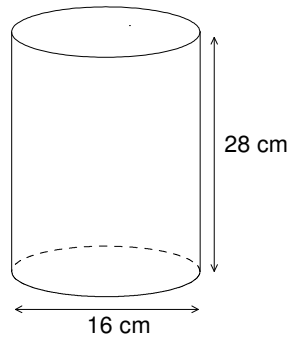
- i. Copy and complete the tree diagram, showing the probability on each branch. /2
- ii. What is the probability that it does NOT snow on either day? /1
- iii. What is the probability that it snows on **at least** one of the two days? /1

- c. Josephine used a radar graph when she compiled her statistics for the number of customers that patronised two adjoining cafes over a seven day period. The radar graph shows her results.



- i. How many customers used Cafe 1 during this seven-day period? /1
- ii. According to the data on the graph, on which day is Cafe 2 busiest? /1
- iii. Without counting the number of people for each cafe, what **one** feature of the graph indicates that Cafe 1 was busier this week than Cafe 2? /1

-
- d. Katrina purchased a ceramic container in the shape of a cylinder which is open at one end. The dimensions are as indicated on the diagram.



She plans to paint and decorate the cylinder on the outside.

Calculate the external surface area to be painted, correct to 1 decimal place.

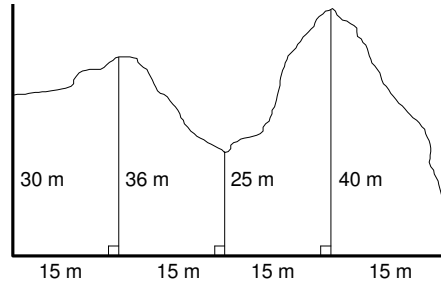
/2

End of Question 25

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

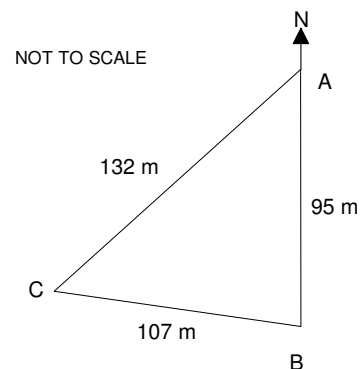
All necessary working should be shown in every question.

- a. As a result of severe storms, sand was washed from McCallum Beach and deposited against a sea wall. Brittany recorded some measurements for this deposit, as shown in the following diagram.



- i. Use Simpson's rule twice to **show** that the area covered by the sand is 1920 m^2 , to the nearest square metre. /3
 - ii. Given that the average depth of the sand was 18 cm, what volume of sand was deposited? Write your answer in cubic metres. /2
- b. William works as an Events Manager. When clients organise for a function for less than 100 people, his quote is based on the cost per person (\$C) varies inversely with the number of people (N) attending. When 60 people attend, the cost is \$36 per person.
- i. **Show** that the value of the *constant of variation* (k) is 2160. Hence, write an equation to represent the above information. /2
 - ii. If only 40 people attend the function, what is the cost per person? /1
 - iii. How many people would have to attend the function for the cost to be \$24 per person? /1
- c. Use the diagram for $\triangle ABC$ to answer the following questions.

- i. **Show** by calculation that the size of $\angle ABC$ is 81° , to nearest degree.



- ii. Hence, calculate the bearing of C from B. /1

End of Question 26

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

All necessary working should be shown in every question.

a. Geashill, in Ireland is at $(53^{\circ}\text{N}, 7^{\circ}\text{W})$ and Nara in Mali is at $(15^{\circ}\text{N}, 7^{\circ}\text{W})$.

i. Calculate the distance between Geashill and Nara, along the 7°W meridian of longitude, using $1^{\circ} = 60 \text{ nm}$ on a great circle, then convert to kilometres, giving your answer to nearest km. /1

ii. Calculate the same distance using the Arc length formula, giving your answer to nearest kilometre, Use radius of the earth = 6400 km. /1

iii. Given that the two calculations give a different answer, explain why the answer to **part i** would be the more accurate distance. /1

b. As part of her long-term investment plan, Sarah decided to invest \$800 every 6 months for 17 years, at 6% p.a., compounding bi-annually.

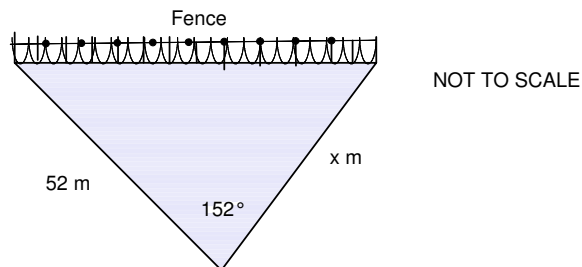
i. **Show** by calculation that the Future Value of Sarah's annuity is \$46 184 (to the nearest dollar)? /2

ii. How much money would Sarah need to invest now so that she will have the same final amount (in **part i**) by the end of 17 years? /2

iii. At the end of the 17 year period, Sarah invests the \$46 184 in an annuity at 12% p.a., compounded monthly, giving her an allowance each month for the next 20 years.

How much is her monthly allowance? /2

c. Emily's backyard is in the shape of a triangle as shown in the diagram.



i. Given that the area of the backyard is 997 m^2 , **show** that the length of the side x is 82 m, correct to 2 significant figures. /2

ii. Hence, how long is the fence at the back of Emily's house? /2

End of Question 27

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

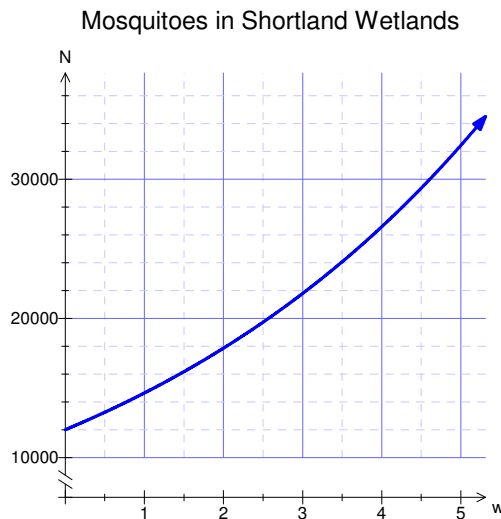
All necessary working should be shown in every question.

- a. The graph on page 14 shows a comparison of the Trial HSC English and Mathematics results for a set of Year 12 Students at MANNION INTERNATIONAL SCHOOL.
- i. Use correct mathematics terminology to describe the correlation of these results. /1
 - ii. What are the coordinates of the three median points? /3
 - iii. Use the graph to correctly draw a median regression line. /2
 - iv. Find the equation of your line. /2
- b. Adrian conducted a research project into the number of mosquitoes found in the vicinity of the Shortland Wetlands Centre over a period of 5 weeks. When comparing his findings from one week (w) to the next he concluded that the number was increasing exponentially. The numbers (N) could be predicted using the formula:

$$N = 12\,000(1.22)^w$$

where N is the number and w is the time in weeks.

Use this formula in conjunction with the following graph to answer the questions.



- i. What is the independent variable of this function? /1
- ii. What is the **value** of the vertical intercept **and explain** what this value indicates in relation to the above scenario. /2
- iii. **From the graph**, estimate how long it took the mosquito population to double. /1
- iv. **Use the function** to predict the number of mosquitoes at 10 weeks, assuming the population continued to grow at the same rate. /1

End of Question 28
END OF PAPER

Question 28

Comparison of Examination Results

