THIRD FORM MATHEMATICS **P. CADOGAN**
Internal Promotion Examination 2013 **Harrison College**

Time $1\frac{3}{4}$ hours **170 copies**

INSTRUCTIONS
This question paper consists of FOUR printed pages.
Write your name clearly on **EACH** sheet of paper used.
Number your answers carefully and do **NOT** do questions beside each other.

All of the questions are to be attempted, and number them identically as they appear on the question paper. Calculators are allowed.
If a numerical answer cannot be given **exactly**, and the accuracy required is not specified in the question, then in the case of an angle it must be given correct to **one (1)** decimal place, in other cases it must be given correct to **three (3)** significant figures.

Write on your foolscap the **LETTER** that matches your response for Questions 1 – 10.
All working **MUST** be shown for questions 11 – 20.

1. The median of the sample 6, 5, 11, 9, 8, 5, 8 is:

(A) 5 **(B)** 8 **(C)** 11 **(D)** 9

2. The numbers from 1 to 20 inclusive are each written on a separate piece of paper and placed in a bag. The probability that a piece of paper drawn at random from the bag has the number 3 on it is:

(A) $\frac{1}{10}$ **(B)** $\frac{3}{20}$ **(C)** $\frac{1}{20}$ **(D)** $\frac{1}{2}$

3. If v pens are bought for t dollars each, and w pens for u dollars each, then The average cost per pen, in dollars, is:

(A) $\frac{v+w}{2}$ **(B)** $\frac{vt+wu}{2}$ **(C)** $\frac{v+w}{t+u}$ **(D)** $\frac{vt+wu}{v+w}$

4. $\frac{a^2b(a+b)}{ab} =$

(A) $a^2(1 + b)$ **(B)** $b(a + b)$ **(C)** $a\ (a + b)$ **(D)** $a^3b^2(a + b)$

5. In the expression $p = x – yz$, z can be written as:

(A) $\frac{x-p}{z}$ **(B)** $\frac{x-p}{y}$ **(C)** $\frac{p}{z-x}$ **(D)** $\frac{p-x}{z}$

6. $(2x^3)^3$ can be expressed as:

(A) $6x^9$ **(B)** $8x^6$ **(C)** $6x^6$ **(D)** $8x^9$

7. An example of a one-to-one mapping over the domain $\{-2, -1, 0, 1, 2\}$ is:

(A) $x \rightarrow 2x + 1$ **(B)** $x \rightarrow x^2 + 2$ **(C)** $x \rightarrow 2 - x^2$ **(D)** $x \rightarrow 2x^2 + 1$

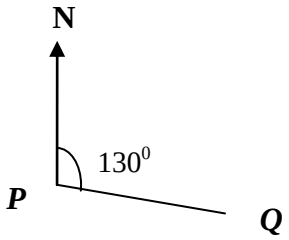
8. Given that k is a constant and that p is inversely proportional to q, then:

(A) $p = kq$ **(B)** $p = \frac{q}{k}$ **(C)** $p = \frac{k}{q}$ **(D)** $q = pk$

9. The gradient of the line $3x - 2y = 6$ is:

(A) $\frac{3}{2}$ **(B)** $\frac{3}{2}$ **(C)** $-\frac{2}{3}$ **(D)** $-\frac{3}{2}$

10. In the diagram below, the bearing of ***P*** from ***Q*** is:



(A) 50^0 **(B)** 230^0 **(C)** 310^0 **(D)** 90^0

[10]

11. A computer cost \$ 3000. It depreciates in value at the rate of 8 % per annum. Calculate
(i) the amount of depreciation after one year. [2]
(ii) the cost of the computer after two years. [3]

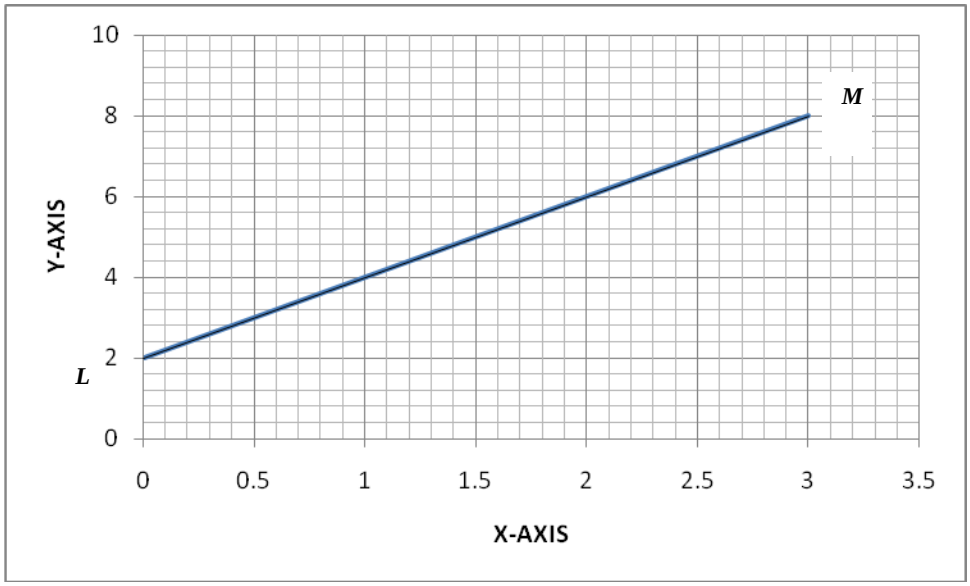
12. y is directly proportional to the square of x and $y = 3$ when $x = 2$.
Calculate
(i) the value of the constant of proportionality [3]
(ii) the value of y when $x = 4$. [2]

13. Solve for x, $4(x + 2) \geq 3(x - 1) + 1$. [5]

14. Solve for x and y, the pair of simultaneous equations: [6]

$$3x - 5y = 11$$
$$5x - y = 11$$

15. The figure below (not drawn to scale) shows a line segment *LM*.



(i) Write down the coordinates of the points *L* and *M*. [2]

Find, by calculation

(ii) the length of the line segment *LM*. [2]

(iii) the coordinates of *P*, which is the mid-point of the line segment *LM*. [3]

(iv) the gradient of the line segment *LM*. [2]

(v) the equation of the perpendicular line that passes through the mid-point of the line segment *LM*. [4]

16. A married woman has three children aged 9, 12 and 17 years. She earns a gross income of $40 000 per annum. Income tax is levied at the rate of 4 % of taxable income.

Category of Person	**Tax-Free Allowance per Year**
Single woman	$ 1 200 per annum
Married woman	$ 2 000 per annum
Child under 11 years old	$ 300
Child 11 to 16 years old	$ 500
Child over 16 years but under 18 years	$ 900

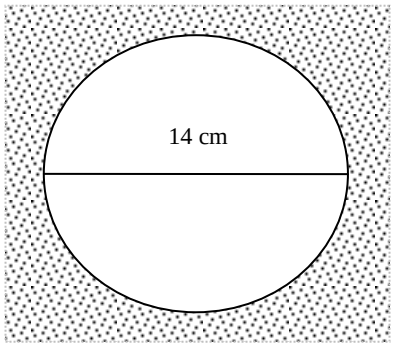
Using the information in the above table, calculate

(i) her total tax-free allowances [5]

(ii) her taxable income [2]

(iii) the amount of income tax paid. [2]

17. A block of wood is 6 cm high. The block has uniform cross-section in the form of a square of side 16 cm.

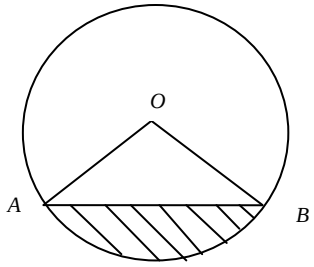


A cylindrical portion is carved out of the block. The cylindrical hole remaining is 5 cm deep and the diameter of its cross-section is 14 cm. The figure above, (not drawn to scale), shows the top surface of what remains.

Taking $\pi = \frac{22}{7}$, calculate, EXACTLY

(a) the volume of the rectangular block of wood before carving. [2]
(b) the area of the wooden top surface of the block after carving. [3]
(c) the capacity of the hole in the block. [2]
(d) the volume of wood remaining in the block after carving. [2]

18. In the below, (not drawn to scale), *O* is the centre of the circle of radius 9 cm. Chord *AB* is of length 14 cm.



(a) Use Hero's formula, $\sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$, to calculate the area of triangle *AOB*. [5]

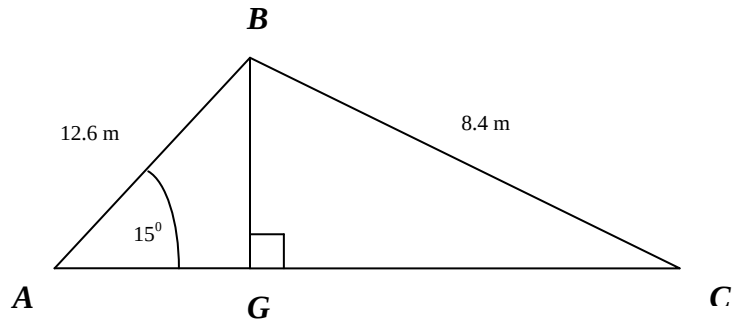
(b) Given that angle *AOB* is 102^0, using $\pi = 3.142$, calculate to 1 decimal place
(i) the area of the sector *AOBC*.
(ii) the area of the shaded region *ABC*. [3]
[2]

19. The heights of a sample of students were recorded as shown in the table below.

Height (cm)	Number of Students
140 – 144	5
145 – 149	17
150 – 154	12
155 – 159	6

(i) Determine the range of the heights [2]
(ii) State the modal class. [1]
(iii) Calculate the mean height of the students. [5]
(iv) Determine the probability that a student chosen at random is at least 150 cm. [2]

20. The diagram below (not drawn to scale) shows ΔABC which represents the cross section of a roof. BG is perpendicular to AGC. AB = 12 metres, BC = 8.4 metres and angle $BAG = 15^0$.



Calculate correct to 3 significant figures
(i) the length of BG. [3]
(ii) angle CBG. [3]
(iii) Calculate the distance AC. [2]

End of Examination