THIRD FORM MATHEMATICS   **P. CADOGAN**
Promotion Examination 2008   **Harrison College**

Time $1\dfrac{3}{4}$ hours   **145 Copies**

This question paper consists of FOUR printed pages.
Write your name clearly on **ALL** sheets of paper used.
All of the questions are to be attempted.
Calculators are allowed.
<u>Write on your foolscap</u> the letter that matches your response for Questions 1 – 5.
All working **MUST** be shown for questions <u>6 – 17</u>.
Number your answers carefully and do **NOT** do questions beside one another.

1. If $p * q = 3p - q$, then $-5 * 3$ is

   (A) -81   (B) 2   (C) -18   (D) -12

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

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

3. In the expression $w = x + yz$, y can be written as:

   (A) $\dfrac{x-w}{z}$ B) $w = \dfrac{x}{z}$ (C) $\dfrac{w}{z-x}$ (D) $\dfrac{w-x}{z}$

4. The value of $\dfrac{6m-n}{n-3}$ where $m=2$ and $n=-3$ is:

   (A) $-\dfrac{5}{2}$ (B) $-\dfrac{9}{6}$ (C) 0   (D) $\dfrac{15}{6}$

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

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

                                                                              [5 marks]

6. Simplify the following:
   a) $3x^3 \times \dfrac{1}{2}x^{-5}$
   b) $5a^5 \div (a^2 \times 4a)$ [5 marks]

7. The line joining the points P and Q has coordinates given by P (-3, 5) and
   Q (2, -7) respectively. Find the

i)   mid-point of PQ
ii) gradient of PQ
iii) length of the line PQ
iv) equation of the line PQ.   [13 marks]

8.

$$\begin{pmatrix} SETA \\ 1 \\ 3 \\ 5 \\ 7 \\ y \end{pmatrix} \quad \begin{pmatrix} SETB \\ 1 \\ 9 \\ 25 \\ x \\ 81 \end{pmatrix}$$

The relationship above is such that corresponding elements of SET A are mapped
to the corresponding elements of SET B.

   i)   Write an equation in x and y to describe the mapping above.
   ii) Determine the values of x and y in the sets above.   [3 marks]

9. Solve for p and q the simultaneous equations

   $2p + 3q = -11, -3p + 2q = -3$ [7 marks]

10. y is inversely proportional to the square of x and $y = 3$ when $x = 2$.
    Calculate the <u>EXACT</u> value of

    i) the value of the constant of proportionality
    ii) the value of y when $x = 6$.   [5 marks]

<u>Question 11 is to be answered on the graph paper provided.</u>

11. a) Copy and complete the table below for the function $f(x) = x^2 - 3x - 4$.

x	-3	-2	-1	0	1	2	3	4	5	6
$y=f(x)$			0			-6	-4		6	

   b) Using a scale of 1cm to represent 1 unit on the *x-axis* and 1 cm to represent
      1 unit on the *y-axis*, draw the graph of the function $y = f(x)$ for $-3 \le x \le 6$.

   c) From your graph determine the values of x for which $y = 0$.
                                                                   [12 marks]

12. $500 is invested in a deposit account at 4% compound interest per annum.
    Find, by calculation, how much interest is earned after two years?   [4 marks]

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13. Jamie's gross salary is $ 3500 per month. Her tax-free allowances are shown in Table A below.

TABLE A: Tax-free Allowances

| National Insurance	5% of Gross Salary
Personal Allowance	$ 4000 per year

Calculate
i) her gross yearly salary
ii) her total tax-free allowances for the year
iii) her taxable yearly income.
iv) A 10% tax is charged on the first $25 000 of taxable income.
    A 20% tax is charged on the portion of taxable income above $25 000.
    Calculate the amount of income tax Jamie pays for a year.

[9 marks]

14. Using a ruler and compasses ONLY, construct the triangle ABC with angle ABC = 90^0, angle ACB = 30^0 and BC = 8cm. Measure and state the length of AC. ALL construction lines and arcs must be CLEARLY SHOWN. [5 marks]

15.

C
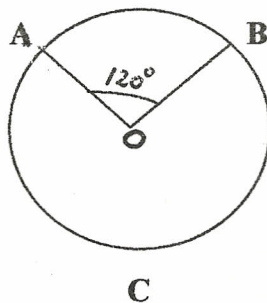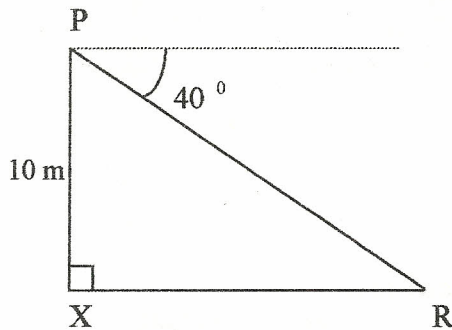
The diagram above, not drawn to scale, shows a circle, centre O, and radius 7 cm. ∠ AOB = 120^0.

Taking $\pi = \dfrac{22}{7}$, calculate, giving correct units, the EXACT value of

a) i) the area of the minor sector AOB
   ii) the perimeter of the region bounded by the lines AO and OB, and the arc BCA.

b) The above circle represents the base of a container 15 cm high, calculate the
   i) volume of this container.
   ii) surface area of the **closed** container.

[14 marks]

16.

P

40 °

10 m

X   R

In the diagram above, not drawn to scale, the points X and R are on a straight line in the same horizontal plane. The angle of depression of a point R from the top of a tower PX, 10 m high, is 40°.

Calculate, giving correct units

i)   the length of XR to 1 decimal place.
ii)   the area of triangle PXR to 1 decimal place
iii)   the bearing of P from R.

[8 marks]

17. The table below shows the heights of a group of 40 students

Height (cm)	No. of students
141 – 145	3
146 – 150	9
151 – 155	15
156 – 160	12
161 - 165	1

i) By finding the mid-interval value, calculate the mean height of the students.
ii) For this set of data calculate the range.
iii) Calculate the probability that a student chosen at random is at least 150.5 cm

[10 marks]

Only attempt question 18 after you have checked over your work for questions 1 – 17.

18. The roots of the equation $ax^2 + bx + c = 0$, are given by $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Find the TWO roots of the equation $2x^2 - 5x + 3 = 0$.

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