HILLCREST HIGH SCHOOL

Grade 11 **MATHEMATICS PAPER 1** **November 2011**
Time: 2hrs
Marks Total: 100

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions:

1. This question paper consists of SEVEN questions. Answer ALL the questions.
2. Clearly show ALL calculations, diagrams, graphs, et cetera you have used in determining the answers.
3. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
4. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
5. Number the answers correctly according to the numbering system used in this question paper.
6. Diagrams are NOT necessarily drawn to scale.
7. It is in your own interest to write neatly and legibly.
8. An Information Sheet is provided. (Formulae Sheet).
9. A sheet of squared paper is provided for questions 6 and 7.
   Please write your name and your teacher's name on this sheet.

1. Simplify

1.1 $\frac{1}{b}+\frac{3}{2b}-\frac{5}{2b}$ (3)

1.2 $\frac{3x^2+2x-5}{3x+5}$ (3)

[6]

2.1 Solve for x correct to 2 decimal places where necessary:

2.1.1 $3x^2 + 2x - 5 = 0$ (3)

2.1.2 $3x^2 - 5x = 4$ (5)

2.1.3 $2x^2 - 5x - 3 < 0$ (4)

2.2 Solve for x and y simultaneously if :-

$y + 3x = 2$ and

$y^2 - 9x^2 = 16$ (5)

2.3 Simplify without using a calculator: (all working must be shown)

2.3.1 $\frac{2^{3x-2}\times 2^{1-2x}}{2^{x-1}\times 4^{-x}}$ (3)

2.3.2 $\frac{\sqrt{72}+3\sqrt{50}-5\sqrt{8}}{\sqrt{2}}$ (4)

[24]

3.1 After 4 years of reducing balance depreciation, the office equipment has $\frac{1}{4}$ of its original value. The original value of the office equipment was R86 000.

3.1.1 Calculate the value of the equipment after 4 years. (1)

3.1.2 Calculate the depreciation interest rate as a percentage. (4)

3.2 R28 000 is invested for 10 years. The interest is calculated at 9,3% p.a. compounded monthly for the first 4 years.
After 4 years the interest rate is increased to 11,8% p.a. compounded quarterly.

3.2.1 Calculate the value of the investment after 4 years. (3)

3.2.2 Calculate the value of investment at the end of 10 years. (3)

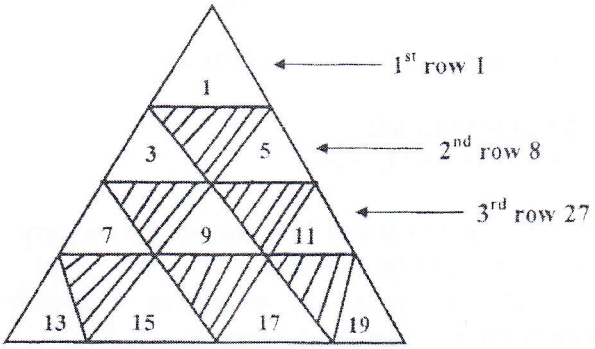
3.3 Calculate the effective interest rate if R40 000 is invested at 8% p.a. compounded daily. (4)

[15]

4.1 Given the sequence:- 3; 9; 19; 33; .....

4.1.1 Determine the 5^{th} term of the sequence. (2)
4.1.2 Derive a formula for the n^{th} number in the sequence. (7)
4.1.3 Calculate the 50^{th} term in the sequence. (2)

4.2

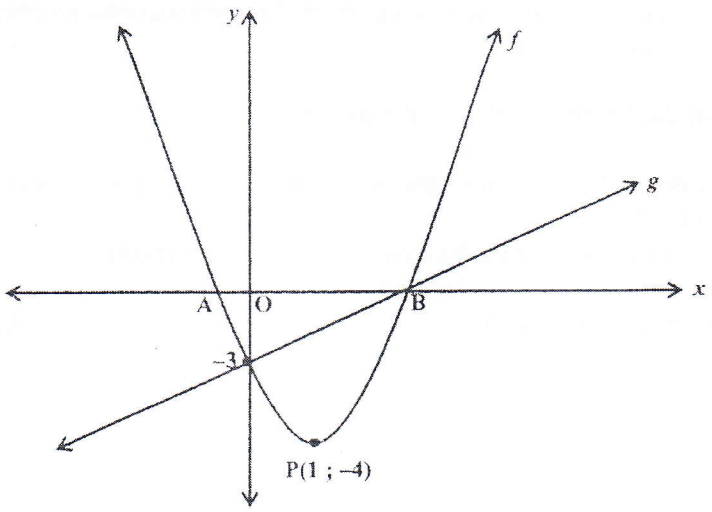


With reference to the figure above:

4.2.1 Write down the sum of the numbers in the 5^{th} row. (2)
4.2.2 Hence, calculate a formula for the sum of numbers in the n^{th} row. (2)

[15]

5.



The sketch shows a graph of a parabola f, and straight line, g. P(1; -4) is the turning point of f. f and g cut the Y axis at (0; -3).

5.1 Show that $f(x) = x^2 - 2x - 3$. (6)

5.2 Calculate the co-ordinates of B. (4)

5.3 Determine the equation of $g(x)$. (4)

5.4 If $h(x) = f(x + 2)$, then determine the turning point of $h(x)$. (2)

[16]

6. **Given** $g(x) = \frac{4}{x-2} - 1$

6.1 Write down the domain of g. (2)

6.2 For which value(s) of x is $g(x) = 0$? (2)

6.3 Write down the equations of the asymptotes of $g(x)$. (2)

6.4 Draw a neat sketch of g on the squared paper provided. (3)

[9]

7. Joseph plans to build toy vehicles of wire to sell.
He decides to build two kinds: motorcars and lorries.

- It takes 1 hour to build a motorcar and 1½ hours to build a lorry.
- He cannot work longer than 12 hours per day.
- The person who provides the tyres for the vehicles can only provide tyres for a maximum of 9 motorcars and 6 lorries.

His profit is R15,00 on a car and R 10,00 on a lorry.

(Suppose he builds **x** motorcars and **y** lorries per day)

7.1 Write down the restrictions for this situation. (4)

7.2 Use the squared paper provided to represent these restrictions graphically. Indicate the feasible region. (4)

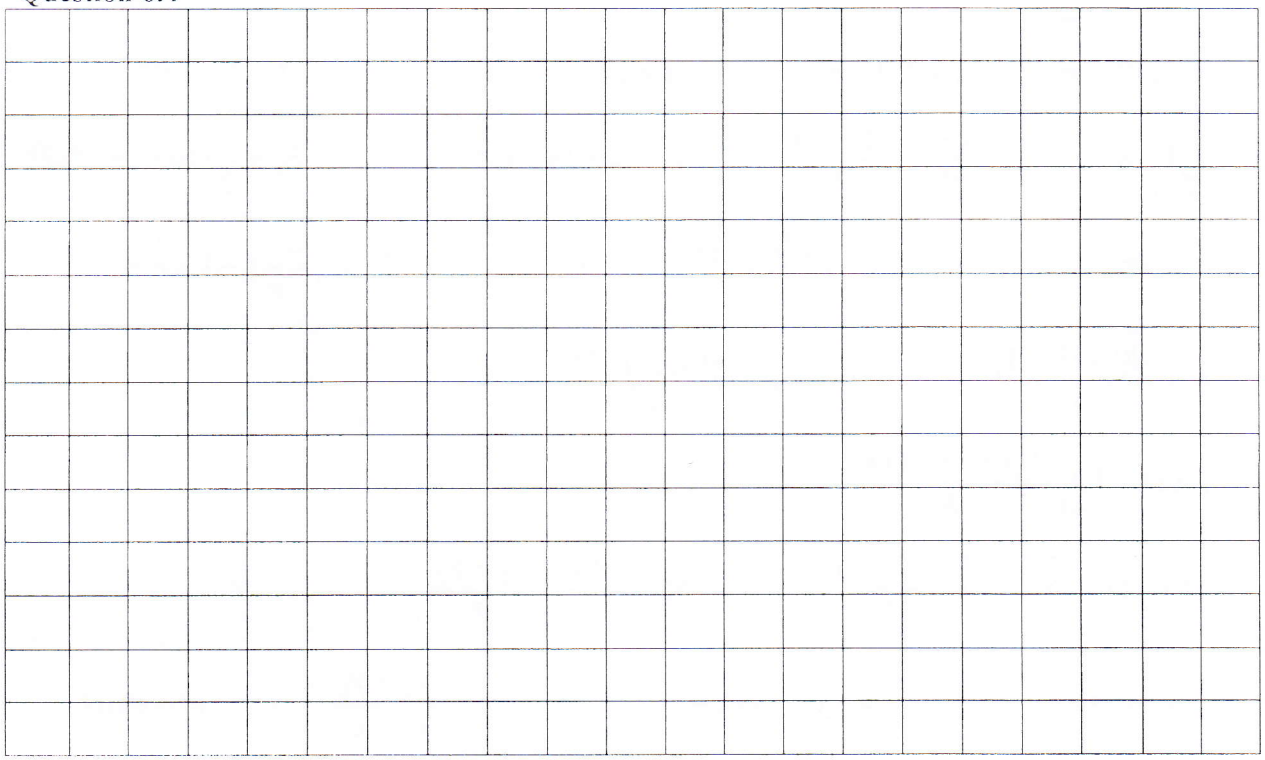
7.3 Write down the Profit function: $P = ax + by$ (2)

7.4 Now select the different combinations of vehicles which could render a maximum profit.
How many of each kind must be built for a maximum profit? (4)

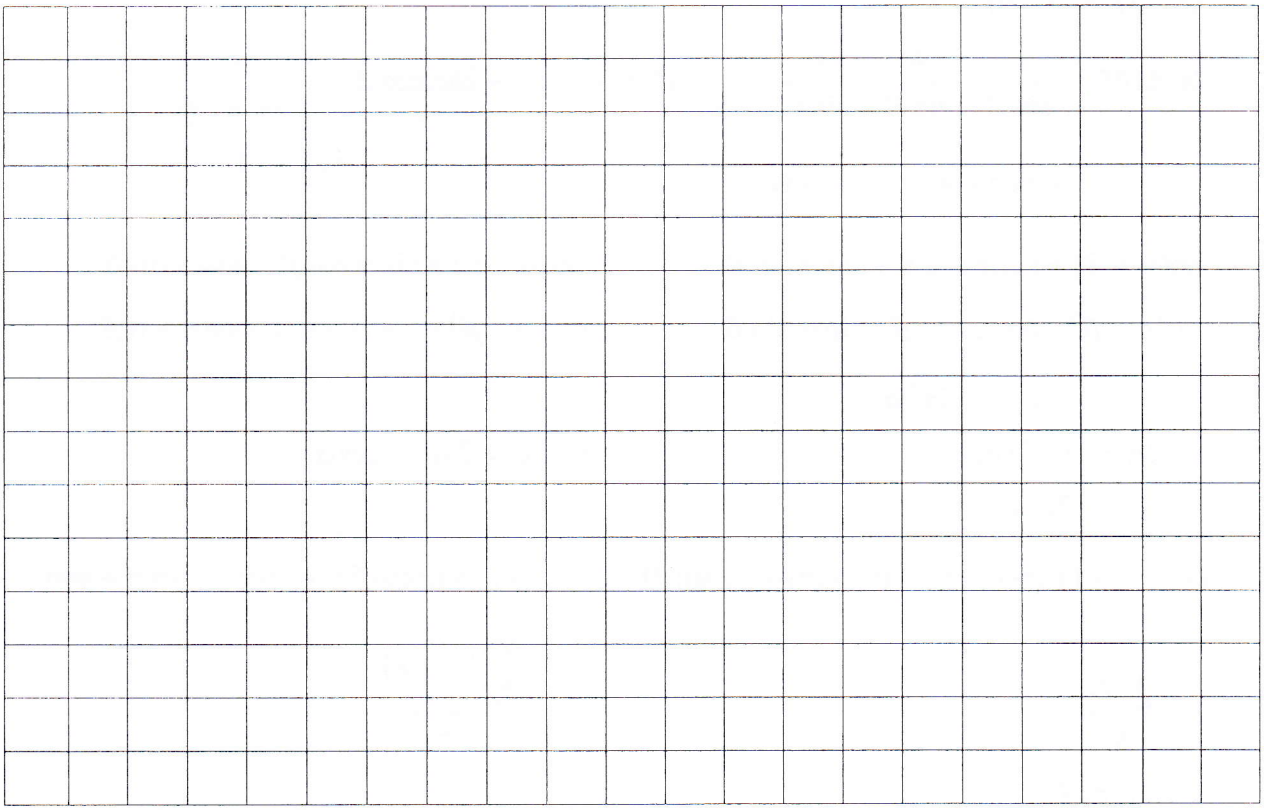
7.5 What is this maximum profit? (1)

[15]

Question 6.4



7.2



INFORMATION SHEET: MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$A = P(1+ni)$ $A = P(1-ni)$ $A = P(1-i)^n$ $A = P(1+i)^n$

$\sum_{i=1}^{n} 1 = n$ $\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$ $T_n = a + (n-1)d$ $S_n = \frac{n}{2}(2a + (n-1)d)$

$T_n = ar^{n-1}$ $S_n = \frac{a(r^n - 1)}{r-1}$; $r \neq 1$ $S_\infty = \frac{a}{1-r}$; $-1 < r < 1$

$$F = \frac{x[(1+i)^n - 1]}{i} \qquad P = \frac{x[1-(1+i)^{-n}]}{i}$$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$y = mx + c$ $y - y_1 = m(x - x_1)$ $m = \frac{y_2 - y_1}{x_2 - x_1}$ $m = \tan\theta$

$$(x-a)^2 + (y-b)^2 = r^2$$

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $a^2 = b^2 + c^2 - 2bc.\cos A$

$$area\ \Delta ABC = \frac{1}{2}ab.\sin C$$

$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta$ $\sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$

$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta$ $\cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$

$$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases} \qquad \sin 2\alpha = 2\sin\alpha.\cos\alpha$$

$(x\ ;\ y) \to (x\cos\theta + y\sin\theta\ ;\ y\cos\theta - x\sin\theta)$ $(x\ ;\ y) \to (x\cos\theta - y\sin\theta\ ;\ y\cos\theta + x\sin\theta)$

$$\bar{x} = \frac{\sum fx}{n} \qquad \sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$$

$$P(A) = \frac{n(A)}{n(S)} \qquad P(A\ or\ B) = P(A) + P(B) - P(A\ and\ B)$$

$$\hat{y} = a + bx \qquad b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$$