Name and Surname   :   ....

Teacher   :   ....

Hudson Park High School

GRADE 10

MATHEMATICS
Paper 1

Time   : 3 hours

Date   : 5 November 2012

Marks   : 150

Examiner : SLT

INSTRUCTIONS

1.   Illegible work, in the opinion of the marker, will earn zero marks.

2.   Number your answers clearly and accurately.

3.   **NB**   **Start each question at the top of a new side of a page.**

4.1.   Fill in the details requested at the top of this page (of the question paper).

4.2. **NB** Hand in your answers and question paper **separately**.

5.   **NB**   **Staple your foolscap answers in the correct order.**

6.   Employ relevant formulae and show all working out. Answers alone may not be awarded
            full marks.

7.   (Non programmable and non graphical) Calculators may be used, unless their usage
            is specifically prohibited.

8.   Round off answers to 2 decimal places, where necessary, unless instructed otherwise.

QUESTION 1 [9 marks]

1.1.   Given : $K = (2x + 1)^2 - (2x - 1)^2$

1.1.1.1.   Multiply K out and then simplify as far as possible. $\underline{3}$
1.1.1.2.   Factorise K fully and then simplify as far as possible. $\underline{2}$ $\underline{5}$

1.1.2.   Hence, without the use of a calculator, evaluate :

$$(100\ 001)^2 - (99\ 999)^2$$ $\underline{2}$ (7)

1.2.   If : $x + \dfrac{1}{x} = 9$, evaluate : $x^2 + \dfrac{1}{x^2}$ (2)

QUESTION 2 [24 marks]

2.1.   Factorise fully :

2.1.1. $x(x - 1) - y(y - 1)$ $\underline{4}$

2.1.2. $16x^2 - 12x - 18$ $\underline{2}$

2.1.3. $x^2 - \dfrac{1}{6}x - 2$ $\underline{2}$ (8)

2.2.   Write as a single term, fully factorised :

$$\frac{3}{x + 2} - x$$ (4)

2.3.   Simplify fully :

$$\frac{\dfrac{1}{x^3} - \dfrac{1}{y^3}}{\dfrac{y}{x} - \dfrac{x}{y}}$$ (5)

2.4.   Write as a single term, simplifying fully :

$$\frac{5}{x^2 - 4} + \frac{x + 1}{3(2 - x)} - \frac{1}{-12 - 6x}$$ (7)

QUESTION 3 [33 marks]

3.1.   Solve for x :

3.1.1. $2x^3 - 3x^2 + 8x - 12 = 0$ <u>4</u>

3.1.2. $\dfrac{2x - 3}{x + 2} = \dfrac{2x - 3}{x + 2}$ <u>2</u>

3.1.3. $0 = -\dfrac{3}{x - 5} + 4$ <u>2</u>

3.1.4. $\dfrac{3x - 1}{x + 1} = \dfrac{5x + 1}{3x - 1}$ <u>6</u>

3.1.5. $5x^{\frac{2}{3}} - 4 = 0$ <u>4</u>

3.1.6. $8\pi x - 680x^{-2} = 0$ <u>3</u>

3.1.7. $4a^2x - 2a = b^2x - b$ <u>4</u>   (25)

3.2.   Given : $-3 < 4 - 2x \le 5$

3.2.1.   Solve for x. <u>2</u>

3.2.2.   State your answer to (3.2.1.) :
3.2.2.1.   on a number line <u>1</u>
3.2.2.2.   in interval notation. <u>1</u> <u>2</u> (4)

3.3.   Solve for x and y :

$$4y + 3x = 18$$
$$2x + y = 2$$

(4)

CALCULATORS MAY NOT BE USED IN THIS QUESTION

4.1. Multiply out and simplify as far as possible :

$$3x^{\frac{1}{2}}\left(x^{\frac{1}{2}} - 2x^{-\frac{1}{2}}\right)$$ (2)

4.2. Simplify fully :

$$\frac{\left(2.3^{x+1}\right)^3}{\sqrt{3^{16x}} \, . \, 12^{3-2x}}$$ (4)

4.3. If : $2^x = a$, determine the following in terms of a :

4.3.1. 8^x $\underline{1}$

4.3.2. 2^{x+3} $\underline{1}$

4.3.3. $5. \, 2^{-x}$ $\underline{1}$ (3)

4.4. Factorise fully : $-7x^{-\frac{3}{8}} + 2x^{-\frac{3}{4}} - 4$ (2)

4.5. Solve for x : $4. \, 3^{2x-1} - \frac{1}{3}. \, 3^{2x+2} = -1\frac{2}{3}$ (4)

QUESTION 5 [5 marks]

5.1.   Given : $17 ; 15 ; 13 ; \cdots$

5.1.1.   Write down an expression for the n-th term of the sequence, T_n .   1

5.1.2.   Hence, determine the position of the term whose value is -981 .   2   (3)

5.2.   If : $3x - 1 ; 4x + 7 ; 2x - 5$ are 3 consecutive terms of an arithmetic
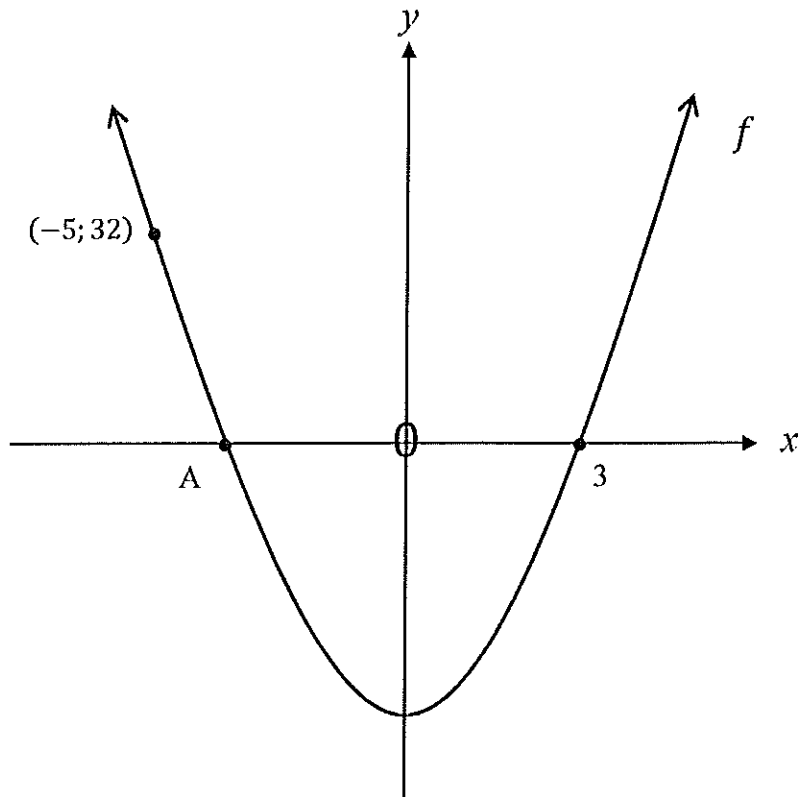   sequence, calculate the value of x .   (2)

QUESTION 6 [4 marks]

6.1.   Given :

         $$f(x) = 3x - 7 \quad \text{and} \quad g(x) = 2$$

         Determine :

6.1.1. $f(5)$ 1

6.1.2. $g(-1)$ 1   (2)

6.2.   Given : $h(x) = -3x + 2$

         Solve for x , if : $2h(x + 4) - 5x = 6$ (2)

QUESTION 7 [10 marks]

7.   On separate sets of axes, sketch neat graphs, showing all relevant details, of :

7.1. $3x - 2y = 12$ (3)

7.2. $y = x$ (3)

7.3. $y = -3^x + 9$ (4)

QUESTION 8 [8 marks]

8.   The axis of symmetry of the parabola, f, shown below, is $x = 0$.

8.1.   Write down the coordinates of A.   (1)

8.2.   Determine the equation of f.   (3)

8.3.   What is the minimum value of f ?   (1)

8.4.   State the values of x for which f is decreasing.   (1)

8.5.   A parabola is also called the "quadratic function".

          Complete the following statements, by writing down only that which is missing :

8.5.1.   "Quadratic" indicates that the highest power of x, in the defining
          equation of f, is ... . $\underline{1}$

8.5.2.   A "function" is a rule (relationship) between x and y, which is

          such that each ... . $\underline{1}$ (2)

QUESTION 9 [13 marks]

9.   Shown below are the graphs of :

$$f(x) = \frac{k}{x} + q \quad \text{and} \quad g(x) = a.b^x + q$$

f and g have the same horizontal asymptote of $y = -4$:
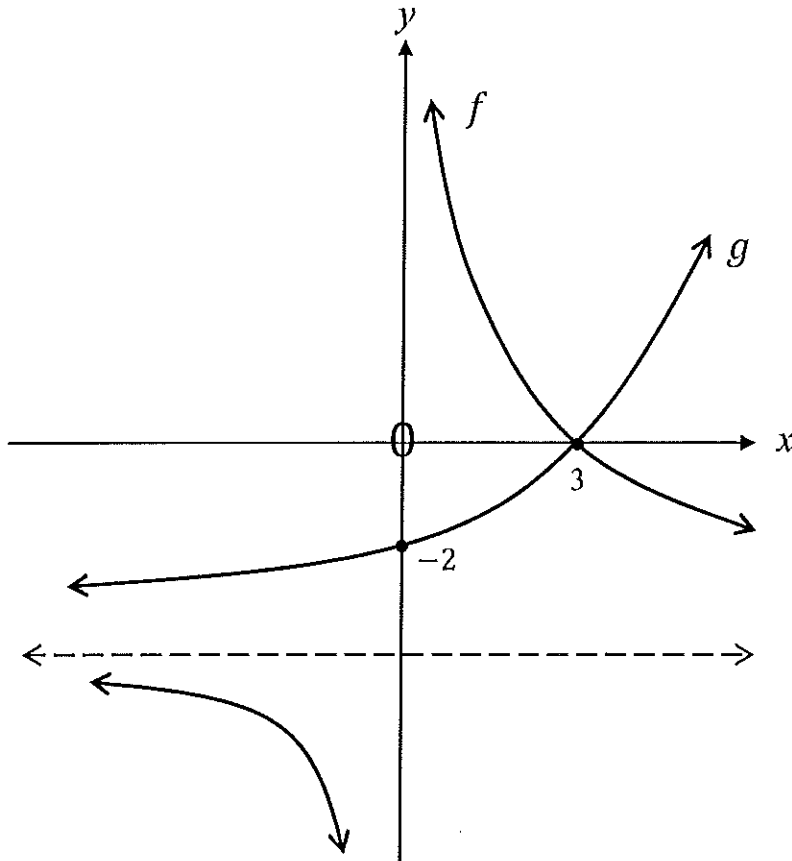
9.1   Calculate the values of q , k , a and b .   (7)

9.2.   Use the graphs to solve for x if :

9.2.1. $f(x) - g(x) < 0$ 2

9.2.2. $f(x).g(x) \geq 0$ 2   (4)

9.3.   Write down the range of f .   (1)

9.4.   State the axis of symmetry of h , if : $h(x) = f(x) \quad (x < 0)$.   (1)

QUESTION 10 [15 marks]

10.1. R 10 000 is deposited into a new savings account on 1st January 2010.
       The bank pays 5 % interest per annum compounded monthly.
       Calculate the balance in the account on the 30 November 2012.   (4)

10.2. How many years will it take for an investment, earning 5 % p. a. compound
       interest, to double in value ?   (3)

10.3. In a certain country, the rate of inflation has remained unchanged for the
       past 6 years. Currently, a roll of wine gums costs R 7,00. 6 years ago,
       the wine gums cost R 4,50. What is the rate of inflation, as a percentage,
       in this country ?   (4)

10.4. A couple buys furniture for R 50 000. They put down a cash deposit of 20 %
       and pay off the balance using a higher purchase agreement, over 4 years.
       The institution charges interest of 10 % p. a. and a monthly insurance fee
   of R 75. Calculate the couple's monthly repayments.   (4)

QUESTION 11 [14 marks]

11.1. Customers at a supermarket were surveyed about their purchases of bread (B)
       and milk (M).

       - 80 customers were surveyed
       - 54 bought bread
       - 42 bought milk
       - 73 bought bread or milk

       Represent the given information as a Venn diagram.
       Show all relevant calculations and working out.   (4)

11.2. Two events, A and B, are mutually exclusive.

       - $P(B') = 0,4$
       - $P(A \cup B) = 0,7$

       Calculate P(A) .   (4)

11.3.   At a certain school, pupils doing the subjects

- Mathematics (M)
- Physical Science (S)
- Accounting (A)

were surveyed. The following Venn diagram represents the results of the survey :

$$\mathcal{U} = 110$$
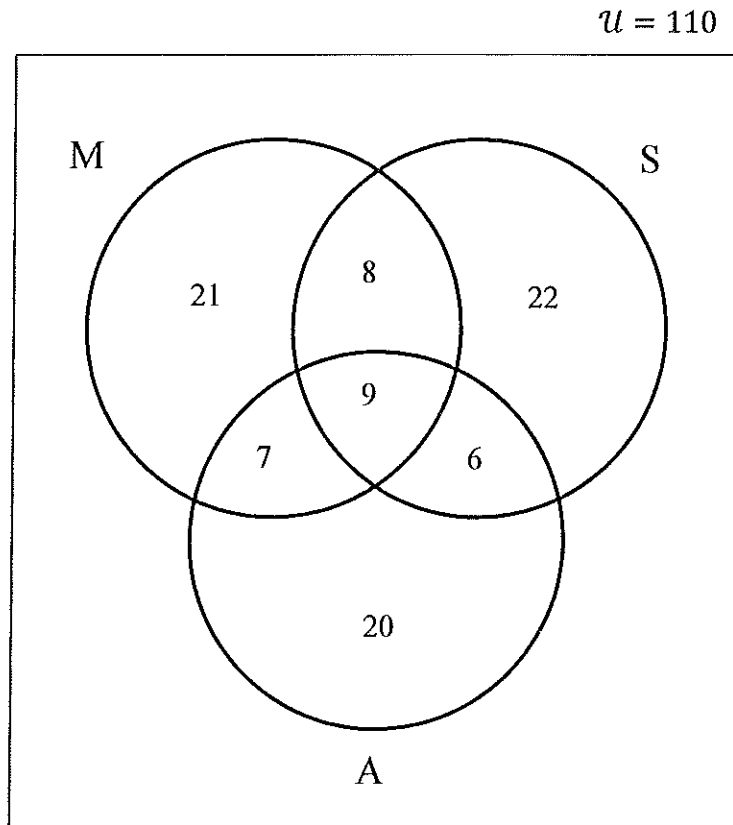
Calculate the probability that a pupil chosen at random does :

11.3.1.	none of the three subjects	1
11.3.2.	only one of the three subjects	1
11.3.3.	at least one of the three subjects	1
11.3.4.	at least two of the three subjects	1
11.3.5.	Mathematics and Accounting, but not Physical Science	1
11.3.6.	M ∪ S'	1 (6)