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Grade 12

MATHEMATICS

Paper 1

Algebra: Equations & Inequalities

Practice Questions

ALL THE BEST!!

QUESTION 1

1.1 Solve for x , rounded off to TWO decimal places where necessary:

$$1.1.1 \quad x^2 = 5x - 4 \quad (3)$$

$$1.1.2 \quad x(3 - x) = -3 \quad (5)$$

$$1.1.3 \quad 3 - x < 2x^2 \quad (5)$$

1.2 Determine the values of x and y if they satisfy both the following equations simultaneously:

$$\begin{aligned} 2x + y &= 3 \\ x^2 + y + x &= y^2 \end{aligned} \quad (8)$$

1.3 Given $x = 999\,999\,999$, determine the exact value of $\frac{x^2 - 4}{x - 2}$.
Show ALL your calculations. (3)

1.4 Explain why the equation $\frac{x^4 + 1}{x^4} = \frac{1}{2}$ has no real roots. (2)
[26]

QUESTION 1

1.1 Solve for x :

$$1.1.1 \quad x(x - 1) = 30 \quad (3)$$

$$1.1.2 \quad 3x^2 - 5x + 1 = 0 \quad (\text{Correct to ONE decimal place}) \quad (4)$$

$$1.1.3 \quad 15x - 4 < 9x^2 \quad (4)$$

1.2 Solve simultaneously for x and y in the following set of equations:

$$\begin{aligned} x - y &= 3 \\ x^2 - xy - 2y^2 - 7 &= 0 \end{aligned} \quad (5)$$

1.3 Calculate the exact value of:

$$\frac{\sqrt{10^{2009}}}{\sqrt{10^{2011}} - \sqrt{10^{2007}}} \quad (\text{Show ALL calculations.}) \quad (3)$$

1.4 Simplify completely without the use of a calculator:

$$\left(1 + \sqrt{2x^2}\right)^2 - \sqrt{8x^2} \quad (3)$$

[22]

QUESTION 1

1.1 Solve for x :

$$1.1.1 \quad (x-3)(x+5) = 9 \quad (4)$$

$$1.1.2 \quad 2x^2 - 2 \leq 3x \quad (4)$$

1.2 Solve simultaneously for x and y :

$$\begin{aligned} 2 + y &= -2x \\ -2x^2 + 8xy + 42 &= y \end{aligned} \quad (7)$$

1.3 If $f(x) = \sqrt{4x}$ and $g(x) = x^2$, determine $f(g(9))$. (3)

1.4 If $\frac{14}{\sqrt{63} - \sqrt{28}} = a\sqrt{b}$, determine, without using a calculator, the value(s) of a and b if a and b are integers. (4)
[22]

QUESTION 1

1.1 Solve for x , correct to TWO decimal places, where necessary:

$$1.1.1 \quad (3-x)(5-x) = 3 \quad (3)$$

$$1.1.2 \quad 3x^2 = 2(x+2) \quad (4)$$

$$1.1.3 \quad 4 + 5x > 6x^2 \quad (4)$$

1.2 Solve for x and y simultaneously:

$$\begin{aligned} 3y &= 2x \\ x^2 - y^2 + 2x - y &= 1 \end{aligned} \quad (7)$$

1.3 Calculate the integer that is the closest approximation to:

$$\frac{5^{2007} + 5^{2010}}{5^{2008} + 5^{2009}} \quad (\text{Show ALL workings.}) \quad (3)$$

[21]

QUESTION 1

1.1 Solve for x , correct to TWO decimal places, where necessary:

1.1.1 $x(x - 1) = 12$ (3)

1.1.2 $2x^2 + 3x - 7 = 0$ (4)

1.1.3 $7x^2 + 18x - 9 > 0$ (4)

1.2 Solve for x and y simultaneously:

$$\begin{aligned} 2x - y &= 7 \\ x^2 + xy &= 21 - y^2 \end{aligned} \quad (7)$$

1.3 Simplify completely, without the use of a calculator:

$$\left(\sqrt[5]{\sqrt{35} + \sqrt{3}} \right) \left(\sqrt[5]{\sqrt{35} - \sqrt{3}} \right) \quad (3)$$

[21]

QUESTION 1

1.1 Solve for x :

1.1.1 $x(x + 1) = 6$ (3)

1.1.2 $3x^2 - 4x = 8$ (4)

1.1.3 $4x^2 + 1 \geq 5x$ (4)

1.2 Consider the equation: $x^2 + 5xy + 6y^2 = 0$

1.2.1 Calculate the values of the ratio $\frac{x}{y}$. (3)

1.2.2 Hence, calculate the values of x and y if $x + y = 8$. (5)

[19]

QUESTION 1

1.1 Solve for x :

1.1.1 $3x^2 - 5x = 2$ (3)

1.1.2 $x - \frac{2}{x} = 5$ (4)

1.1.3 $(x+1)(x-3) > 12$ (4)

1.2 Solve simultaneously for r and p in the following set of equations:

$$\begin{aligned} 6r + 5rp - 5p &= 8 \\ r + p &= 2 \end{aligned} \quad (7)$$

1.3 The volume of a box with a rectangular base is $3\,072\text{ cm}^3$. The lengths of the sides are in the ratio $1 : 2 : 3$. Calculate the length of the shortest side. (4)
[22]

QUESTION 1

1.1 Solve for x in each of the following:

1.1.1 $(2x-1)(x+4) = 0$ (2)

1.1.2 $3x^2 - x = 5$ (Leave your answer correct to TWO decimal places.) (4)

1.1.3 $x^2 + 7x - 8 < 0$ (4)

1.2 Given: $4y - x = 4$ and $xy = 8$

1.2.1 Solve for x and y simultaneously. (6)

1.2.2 The graph of $4y - x = 4$ is reflected across the line having equation $y = x$. What is the equation of the reflected line? (2)

1.3 The solutions of a quadratic equation are given by $x = \frac{-2 \pm \sqrt{2p+5}}{7}$

For which value(s) of p will this equation have:

1.3.1 Two equal solutions (2)

1.3.2 No real solutions (1)
[21]

QUESTION 1

1.1 Solve for x :

$$1.1.1 \quad (x^2 - 9)(2x + 1) = 0 \quad (3)$$

$$1.1.2 \quad x^2 + x - 13 = 0 \quad (\text{Leave your answer correct to TWO decimal places.}) \quad (4)$$

$$1.1.3 \quad 2 \cdot 3^x = 81 - 3^x \quad (4)$$

$$1.1.4 \quad (x + 1)(4 - x) > 0 \quad (3)$$

1.2 Given: $2^x + 2^{x+2} = -5y + 20$

1.2.1 Express 2^x in terms of y . (2)

1.2.2 How many solutions for x will the equation have if $y = -4$? (2)

1.2.3 Solve for x if y is the largest possible integer value for which $2^x + 2^{x+2} = -5y + 20$ will have solutions. (3)

[21]

QUESTION 1

1.1 Solve for x in each of the following:

$$1.1.1 \quad x^2 - x - 12 = 0 \quad (3)$$

$$1.1.2 \quad (\text{a}) \quad 2x^2 - 5x - 11 = 0 \quad (4)$$

$$(\text{b}) \quad 2x^3 - 5x^2 - 11x = 0 \quad (2)$$

$$1.1.3 \quad -3(x + 7)(x - 5) < 0 \quad (4)$$

1.2 Given: $y + 2 = x$ and $y = x^2 - x - 10$

Solve for x and y simultaneously. (6)

1.3 Simplify: $\frac{3^{2015} + 3^{2013}}{9^{1006}}$ (3)

[22]

QUESTION 1

1.1 Solve for x in each of the following:

1.1.1 $x^2 - 2x - 35 = 0$ (3)

1.1.2 $x^2 - 16 \geq 0$ (4)

1.1.3 $9 \cdot 2^{x-1} = 2 \cdot 3^x$ (3)

1.2 Given: $f(x) = x^2 - 5x + c$

Determine the value of c if it is given that the solutions of $f(x) = 0$ are $\frac{5 \pm \sqrt{41}}{2}$. (3)

1.3 Solve for x and y if: $3^{x-10} = 3^{3x}$ and $y^2 + x = 20$. (5)
[18]

QUESTION 1

1.1 Solve for x :

1.1.1 $3x^2 - 4x = 0$ (2)

1.1.2 $x - 6 + \frac{2}{x} = 0$; $x \neq 0$. (Leave your answer correct to TWO decimal places.) (4)

1.1.3 $x^{\frac{2}{3}} = 4$ (2)

1.1.4 $3^x(x-5) < 0$ (2)

1.2 Solve for x and y simultaneously:

$y = x^2 - x - 6$ and $2x - y = 2$ (6)

1.3 Simplify, without the use of a calculator:

$\sqrt{3} \cdot \sqrt{48} - \frac{4^{x+1}}{2^{2x}}$ (3)

1.4 Given: $f(x) = 3(x-1)^2 + 5$ and $g(x) = 3$

1.4.1 Is it possible for $f(x) = g(x)$? Give a reason for your answer. (2)

1.4.2 Determine the value(s) of k for which $f(x) = g(x) + k$ has TWO unequal real roots. (2)
[23]

QUESTION 1

1.1 Solve for x :

1.1.1 $(x-2)(4+x)=0$ (2)

1.1.2 $3x^2 - 2x = 14$ (correct to TWO decimal places) (4)

1.1.3 $2^{x+2} + 2^x = 20$ (3)

1.2 Solve the following equations simultaneously:

$$x = 2y + 3$$

$$3x^2 - 5xy = 24 + 16y$$
 (6)

1.3 Solve for x : $(x-1)(x-2) < 6$ (4)

1.4 The roots of a quadratic equation are: $x = \frac{3 \pm \sqrt{-k-4}}{2}$
For which values of k are the roots real? (2)
[21]

QUESTION 1

1.1 Solve for x :

1.1.1 $x^2 - 9x + 20 = 0$ (3)

1.1.2 $3x^2 + 5x = 4$ (correct to TWO decimal places) (4)

1.1.3 $2x^{\frac{-5}{3}} = 64$ (4)

1.1.4 $\sqrt{2-x} = x-2$ (4)

1.1.5 $x^2 + 7x < 0$ (3)

1.2 Given: $(3x-y)^2 + (x-5)^2 = 0$

Solve for x and y . (4)

1.3 For which value of k will the equation $x^2 + x = k$ have no real roots? (4)
[26]

QUESTION 1

1.1 Solve for x :

$$1.1.1 \quad x^2 - x - 20 = 0 \quad (2)$$

$$1.1.2 \quad 2x^2 - 11x + 7 = 0 \text{ (correct to TWO decimal places)} \quad (3)$$

$$1.1.3 \quad 5x^2 + 4 > 21x \quad (5)$$

$$1.1.4 \quad 2^{2x} - 6 \cdot 2^x = 16 \quad (4)$$

1.2 Solve for x and y simultaneously:

$$\begin{aligned} y + 1 &= 2x \\ x^2 - xy + y^2 &= 7 \end{aligned} \quad (6)$$

1.3 The roots of a quadratic equation are given by $x = \frac{-5 \pm \sqrt{20 + 8k}}{6}$, where $k \in \{-3; -2; -1; 0; 1; 2; 3\}$.

1.3.1 Write down TWO values of k for which the roots will be rational. (2)

1.3.2 Write down ONE value of k for which the roots will be non-real. (1)

1.4 Calculate a and b if $\sqrt{\frac{7^{2014} - 7^{2012}}{12}} = a(7^b)$ and a is not a multiple of 7. (4)

[27]

QUESTION 1

1.1 Solve for x :

$$1.1.1 \quad x^2 - x - 12 = 0 \quad (3)$$

$$1.1.2 \quad x(x+3)-1=0 \text{ (Leave your answer in simplest surd form.)} \quad (3)$$

$$1.1.3 \quad x(4-x) < 0 \quad (3)$$

$$1.1.4 \quad x = \frac{a^2 + a - 2}{a - 1} \text{ if } a = 888\,888\,888\,888 \quad (2)$$

1.2 Solve the following equations simultaneously:

$$y + 7 = 2x \text{ and } x^2 - xy + 3y^2 = 15 \quad (6)$$

1.3 Determine the range of the function $y = x + \frac{1}{x}$, $x \neq 0$ and x is real. (6)
[23]

QUESTION 1

1.1 Solve for x :

$$1.1.1 \quad x(x-7) = 0 \quad (2)$$

$$1.1.2 \quad x^2 - 6x + 2 = 0 \text{ (correct to TWO decimal places)} \quad (3)$$

$$1.1.3 \quad \sqrt{x-1} + 1 = x \quad (5)$$

$$1.1.4 \quad 3^{x+3} - 3^{x+2} = 486 \quad (4)$$

1.2 Given: $f(x) = x^2 + 3x - 4$

$$1.2.1 \quad \text{Solve for } x \text{ if } f(x) = 0 \quad (2)$$

$$1.2.2 \quad \text{Solve for } x \text{ if } f(x) < 0 \quad (2)$$

$$1.2.3 \quad \text{Determine the values of } x \text{ for which } f'(x) \geq 0 \quad (2)$$

1.3 Solve for x and y : $x = 2y$ and $x^2 - 5xy = -24$ (4)
[24]

QUESTION 1

1.1 Solve for x :

$$1.1.1 \quad (x-3)(x+1) = 0 \quad (2)$$

$$1.1.2 \quad \sqrt{x^3} = 512 \quad (3)$$

$$1.1.3 \quad x(x-4) < 0 \quad (2)$$

1.2 Given: $f(x) = x^2 - 5x + 2$

$$1.2.1 \quad \text{Solve for } x \text{ if } f(x) = 0 \quad (3)$$

$$1.2.2 \quad \text{For which values of } c \text{ will } f(x) = c \text{ have no real roots?} \quad (4)$$

1.3 Solve for x and y :

$$\begin{aligned} x &= 2y + 2 \\ x^2 - 2xy + 3y^2 &= 4 \end{aligned} \quad (6)$$

1.4 Calculate the maximum value of S if $S = \frac{6}{x^2 + 2}$. (2)

[22]

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