UNIVERSITY OF COLOMBO SRI LANKA

FACULTY OF ARTS

FIRST YEAR EXAMINATION IN ARTS - SEMESTER I – 2022-23

FND 1107 – BASIC MATHEMATICS

Time: Two (02) Hours

Instructions:

- **Selecting any TWO (02) parts from each question, answer only TEN (10) questions.**
- Each question carries equal marks.
- Calculators are not permitted.
- Read the instructions carefully.
- Provide workings for each answer.

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1. Determine whether the number in each case is either a natural number, a real number, or an unreal number.

   a) $1 - \left(\frac{1}{\sqrt{2}}\right)^2$

   b) $\sqrt[3]{\frac{(-125)^2}{27}}$

   c) $\sqrt{64} - 8$

   d) $(-243)^{3/5}$

2. Determine whether each statement below is correct.

   a) Value of $\sqrt{75}$ is greater than 9

   b) Value of $\sqrt{25}$ is -5 or 5

   c) Value of $\sqrt[4]{(-9)^2}$ is 3

   d) Value of $\sqrt[3]{-27}$ is 3 or -3

3. Determine whether the value of each expression below is either rational or irrational.

   a) $2\sqrt{18} - \sqrt{27}$

   b) $\frac{\sqrt{162}+\sqrt{98}}{2} - \sqrt{2}$

   c) $2\sqrt{20} + 3\sqrt{5}$

   d) $\frac{\sqrt{6}-\sqrt{24}+\sqrt{150}}{\sqrt{6}}$

4. Rationalize the denominator of each expression and simplify.

a) $\dfrac{3}{3-\sqrt{5}}$

b) $\dfrac{\sqrt{3}}{\sqrt{11}-\sqrt{2}}$

c) $\dfrac{2\sqrt{5}}{\sqrt{5}-\sqrt{2}}$

d) $\dfrac{\sqrt{3}+\sqrt{7}}{\sqrt{3}-\sqrt{7}}$

5. Evaluate each of the following expression

a) If $\left(x+\dfrac{1}{x}\right) = 2$, find $\left(x^2+\dfrac{1}{x^2}\right)$

b) $\dfrac{(x+2)}{2} - \dfrac{(x-11)}{8} = \dfrac{1}{4}$, solve for x.

c) $\dfrac{2}{x-3} - \dfrac{7}{2} = \dfrac{9}{x-3}$, Solve for x.

d) $2x^3 + x - 7 \div (x-2)$

6. Evaluate each of the following expressions without using log tables.

a) $\log_{10} 25 + \log_{10} 8 - \log_{10} 2$

b) $\log_a 5 + \log_a x = \log_a 3 + \log_a 10 - \log_a 2$

c) $4\log_5 10 - \log_5 5 - 4\log_5 2$

d) $\log_{10} 200 + \log_{10} 300 - \log_{10} 60$

7. Simplify each of the following expression.

a) $2\{x[2x-3] + 2[2x^2 + (1-5x)]\}$

b) $t\{3(t-2)(t+2) - 5[2t(t+3)]\}$

c) $(t-3)(2t^2 - 2t - 6)$

d) $(\sqrt{x^2-1} - \sqrt{3})(\sqrt{3} + \sqrt{x^2-1})$

8. Determine whether the value of each expression below is correct.

a) $\sqrt{12} + 3\sqrt{27} - \sqrt{18} + \sqrt{8} = 11\sqrt{3} - \sqrt{2}$

b) $\sqrt{50} - \sqrt{32} + 3\sqrt{12} - \sqrt{48} = \sqrt{2} + 2\sqrt{3}$

c) $\sqrt{250} - \sqrt{160} + 2\sqrt{1000} = 21\sqrt{10}$

d) $\sqrt[3]{270} - \sqrt[3]{640} + \sqrt[3]{2160} = 5\sqrt[3]{10}$

9. Determine whether the value of each expression below is correct.

a) $(x^2 - y^{-2})^2 = \dfrac{(x^2y^2 - 1)^2}{y^4}$

b) $(x^{-1} - y^{-3})^3 = \dfrac{(y^3 - x)^3}{x^3y^9}$

c) $(x^{-2} - y)^{-1} = \dfrac{x^2}{1 - x^2y}$

d) $(x^{-2} - y^{-1})^{-1} = \left(\dfrac{xy}{y - x}\right)$

10. Determine whether the roots are real, overlapping, or unreal, and solve for x

a) $3x^2 - 10x + 8 = 0$

b) $x^2 + 2x = 15$

c) $x^2 + 14x + 49 = 0$

d) $3x^2 - 3x - 3 = 0$

11. Solve the following simultaneous equation systems

a) $2x + y + z = 8$
$5x - 3y + 2z = 3$
$7x + y + 3z = 20$

b) $2x + y + z = 7$
$2x - y + 2z = 6$
$x - 2y + z = 0$

c) $x - 3y + 3z = -4$
$2x + 3y - z = 15$
$4x - 3y - z = 19$

d) $3x + 2y + z = 7$
$x - 2y + z = -1$
$2x + y + 2z = 3$

12. Find the equations of the graphs and <u>sketch</u> them. State the arguments you may use in each case. Do not attempt to graph accurately.

a) The line passes through point $A \equiv (2,1)$ and the origin.

b) $y = mx - 3$ that passes through $A \equiv (-1,2)$

c) $y = mx + c$ that is parallel to $y = 5x + c$ and passes through $(-1,2)$

d) $y = \dfrac{1}{2}x + C$ that passes through $A \equiv (0,0)$

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