

Grade 9 Mathematics Worksheet

Equations, expressions and factorization

Questions:

1. a) Simplify the expression $f(x) = 2(3 - 2x) - \frac{1}{3}(3x + 6)$
 b) Solve the equation $f(x) = 2x + 3$ if $f(x)$ is as in (a) above
 c) Solve for x if $3 \times f(x) < (2x + 3)$ if x is an integer and if $f(x)$ is as in (a) above
 d) For which values of x will $f(2x) < -1$? if $f(x)$ is as in (a) above
 e) Solve for x : $\frac{(x^3)^4}{(x^6)(x^2)} = 4096$

2. Factorise the following:
 - a) $2x^2 - 8$
 - b) $2x^2 + 14x - 36$
 - c) $4x^3 - x$
 - d) $8x^3 - 27$
 - e) $4^x - 9$

3. Simplify the following expressions:
 - a)
$$\frac{x^2 - x - 6}{9 - x^2}$$
 - b)
$$\frac{\sqrt{x} - \sqrt{3}}{x - 3}$$
 - c)
$$\frac{2x^2 + 2x}{x} \div \frac{2}{x}$$

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d) $\sqrt[3]{27x^{-6}}$

e) $\frac{9x^2y^3}{18x^{-2}y^1} + \frac{2}{3}$

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Solution:

1. a) $f(x) = 2(3 - 2x) - \frac{1}{3}(3x + 6) = 6 - 4x - x - 2 = 4 - 5x$

b) $f(x) = 2x + 3 = 4 - 5x$

$$\therefore 7x = -1$$

$$\therefore x = -\frac{1}{7}$$

c) $3 \times (4 - 5x) < (2x + 3)$

$$\therefore 12 - 15x < 2x + 3$$

$$\therefore -17x < -9$$

$$\therefore x > \frac{9}{17}$$

So the first value of x will be $x = 1$.

d) $4 - 5(2x) < -1$

$$\therefore 4 - 10x < -1$$

$$\therefore -10x < -5$$

$$\therefore x > \frac{1}{2}$$

e) $\frac{(x^3)^4}{(x^6)(x^2)} = 4096 \rightarrow \frac{x^{12}}{x^8} = 4096 \rightarrow x^4 = 2^{12} \rightarrow x = \pm 2^3 = \pm 8$

2. a) $2x^2 - 8 = 2(x^2 - 4) = 2(x+2)(x-2)$

b) $2x^2 + 14x - 36 = 2(x^2 + 7x - 18) = 2(x+9)(x-2)$

c) $4x^3 - x = x(4x^2 - 1) = x(2x+1)(2x-1)$

d) $8x^3 - 27 = (2x-3)(4x^2 + 6x + 9)$

e) $2^{2x} - 3^2 = (2^x - 3)(2^x + 3)$

3. a) $\frac{x^2 - x - 6}{9 - x^2} = \frac{(x+2)(x-3)}{(3-x)(3+x)} = \frac{(x+2)(x-3)}{-(x-3)(3+x)} = \frac{(x+2)}{-(x+3)}$

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b)
$$\frac{\sqrt{x} - \sqrt{3}}{x-3} = \frac{\sqrt{x} - \sqrt{3}}{(\sqrt{x} + \sqrt{3})(\sqrt{x} - \sqrt{3})} = \frac{1}{\sqrt{x} + \sqrt{3}}$$

c)
$$\frac{2x^2 + 2x}{x} \div \frac{2}{x} = \frac{2(x^2 + x)}{x} \times \frac{x}{2} = x^2 + x \quad \text{or} \quad x(x+1)$$

d)
$$\sqrt[3]{27x^{-6}} = (27x^{-6})^{\frac{1}{3}} = 27^{\frac{1}{3}} x^{-6 \times \frac{1}{3}} = 3x^{-2} = \frac{3}{x^2}$$

e)
$$\frac{9x^2y^3}{18x^{-2}y^1} + \frac{2}{3} = \frac{(x^2y^3) \times (x^2y^{-1})}{2} + \frac{2}{3} = \frac{3(x^4y^2) + 2(2)}{6} = \frac{3x^4y^2 + 4}{6}$$