Year 11 Math Homework

| Student Name: _____ | Grade: _____ |
| Date: _____ | Score: _____ |

Table of Contents

3   Year 11 Topic 3 — Basic Algebra Part 2

3.1   Basic Algebra

3.1.1   Methods of Factorisation

- Identifying a common factor

- Grouping in pairs

- Difference of two squares: $a^2 - b^2 = (a - b)(a + b)$

- Sum and difference of two cubes: $\begin{cases} a^3 + b^3 = (a + b)(a^2 - ab + b^2) \\ a^3 - b^3 = (a - b)(a^2 + ab + b^2) \end{cases}$

- Quadratic trinomial: $x^2 + (m + n)x + mn = (x + m)(x + n)$

Exercise 3.1.1 Factorise the following:
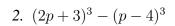
1. $64 - p^2$

2. $\frac{a^2}{36} - 1$

3. $(1 + q)^2 - 1$

4. $(x + 3)^2 - (x - 3)^2$

5. $x^3 - 3x^2 - 9x + 27$

Exercise 3.1.2 Factorise the following:

1. $(3a - b)^3 + 8b^3$

2. $(2p + 3)^3 - (p - 4)^3$

3. $(2x - y)^3 + (x - 2y)^3$

4. $\frac{27p^3}{125} - q^3$

5. $16a^3b^3 + 54c^3$

6. $8x^5 - 72x^3 + x^2 - 9$

Exercise 3.1.3 Factorise the following quadratic trinomials:

1. $x^2 + 12x + 35$

2. $x^2 - 8x + 15$

3. $2x^2 + 7x + 3$

4. $6x^2 - 19x + 14$

5. $9x^2 + 30x + 25$

6. $4x^2 - 4x - 15$

7. $(a + 3b)(a - 3b) - 3c(a + 3b)$

3.1.2 Simplification of Fractions

Exercise 3.1.4 Simplify the following:

1. $\dfrac{x^2+3x}{x^2-9}$

2. $\dfrac{x^2-7x+6}{x^2-36}$

3. $\dfrac{a^2b}{3ab-b^2} \times \dfrac{3a^2-ab}{ab}$

4. $\dfrac{8a^3-1}{8a^2+4a+2}$

5. $\dfrac{x^3-(x-y)^3}{x^2-(x-y)^2}$

3.1.3   Addition and Subtraction of Fractions

Exercise 3.1.5 Simplify the following:

1. $\frac{2a-b}{3} - \frac{a+b}{6}$

2. $\frac{2}{5x} + \frac{3}{7x}$

3. $\frac{4a}{5} - \frac{a}{6} + \frac{2a}{3}$

4. $\frac{a}{a-b} + \frac{b}{a+b}$

5. $\frac{3}{x-2} - \frac{2}{x^2-4}$

6. $\frac{1}{x+y} - \frac{1}{x-y}$

3.2 Equations and Inequations

3.2.1 Linear Equations with One Variable

Exercise 3.2.1 Solve the following equations with respect to x:

1. $3(x + 3) = 4(9 - 3x)$

2. $8(x + 2) - 2(x - 2) = 3(x + 5)$

3. $18 - 2(x + 2) = 3(x - 2)$

Exercise 3.2.2 Solve the following equations with respect to x:

1. $\frac{5}{2x-1} = \frac{3}{x+2}$

2. $\frac{x+4}{2} - \frac{3-4x}{4} = \frac{5-x}{8}$

3. $\frac{3}{x-2} - \frac{2}{x+2} = \frac{1}{x^2-4}$

3.2.2 Inequations

If both sides of an inequation are multiplied or divided by a negative number, the direction of the inequality sign is reversed.

Exercise 3.2.3 Solve the following inequations:

1. $7x < 2(3x - 5)$

2. $3x - 2 \geq x + 3$

3. $\frac{2x-1}{3} > -1$

4. $\frac{4x}{3} + 3 \geq \frac{7x}{3}$

5. $\frac{x-5}{3} > \frac{5x-3}{2}$

6. $-2 \leq \frac{3x-1}{2} < 2$

3.2.3 Square Roots and Absolute Values

- $\sqrt{x^2} = x$ if $x > 0$
- $\sqrt{x^2} = -x$ if $x < 0$
- $\sqrt{x^2} = 0$ if $x = 0$
- $|x| = x$ if $x > 0$
- $|x| = -x$ if $x < 0$

- $|x| = 0$ if $x = 0$
- $\sqrt{x^2} = |x|$
- $|xy| = |x| \times |y|$
- $|x + y| \leq |x| + |y|$
- $|x + y| = |x| + |y|$ *

* When and only when x and y are either both zero or both have the same sign.

Exercise 3.2.4 Solve for x:

1. $|2x - 1| = 3$

2. $|5x - 3| = 2$

3. $|2 - 4x| = 1$

4. $|3x - 2| \geq 1$

5. $|2x - 1| < 3$

Exercise 3.2.5 Give meaning to:

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

2. $\sqrt{(3x-y)^2}$

Exercise 3.2.6 Simplify the following:

1. $\frac{|x-3|}{x^2-9}$

2. $\frac{\sqrt{(x-1)^2}}{x-1}$

3. $\frac{|x^2-1|}{x+1}$

4. $\sqrt{x^2-6x+9}$

3.2.4   Quadratic Equations

$$ax^2 + bx + c = 0, \ a \neq 0$$

Exercise 3.2.7 Solve the following quadratic equations:

1. $25x^2 = 9$

2. $2x^2 - 8 = 0$

3. $5x^2 + x = 0$

4. $2x^2 - 5x = 0$

5. $5x^2 = 3x + 2$

6. $x^2 = 4(x - 1)$

Exercise 3.2.8 Solve the following quadratic equations by completing the square:

1. $x^2 - 10x - 11 = 0$

2. $x^2 = 4x$

3. $x^2 + 2x - 3 = 0$

Exercise 3.2.9 Solve the following quadratic equations by using the quadratic formula:

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

1. $2x^2 - 3x + 1 = 0$

2. $x^2 + 2x - 4$

3. $3x^2 + 9x + 5 = 0$

3.3 Miscellaneous Exercises

Exercise 3.3.1

1. Solve $20 \leq 5x - 5 \leq 30$.

_____

_____

_____

2. Write expressions for the following:

(a) $\sqrt{x^2 - 10x + 25}$ *when* $x > 5$

_____

_____

_____

(b) $\sqrt{(2x + 1)^2}$

_____

_____

_____

3. Solve for x:

(a) $|2x - 2| = 2$

_____

_____

_____

(b) $|5x + 1| = 4$

_____

_____

_____

Exercise 3.3.2 Solve the following quadratic equations:

1. $x^2 - 2x - 4 = 0$

2. $3x^2 - 8x + 3 = 0$

3. $5x(x + 2) = 3x - 2$

4. In a right-angled triangle, one of the sides adjacent to the right angle is 4 cm longer than the other side. Find the length of all three sides if the area of the triangle is 96 cm^2.

5. A rectangular swimming pool 12 m by 8 m is surrounded by a concrete path of uniform width. If the area of the path is 224 m^2, find its width.