

**Directions:** This algebra review is to be done on your own. It will not be collected or graded. However, the algebraic skills which these problems embody will be needed throughout the semester within the context of more involved calculus problems.

1. Expand the following formulae:

(a)  $(4x^2 - 1)(4x^2 + 1)(x - 2)$

(b)  $(x + \alpha^2)(x - \alpha^2)(x - \beta)(x + \beta)$

2. Factor the following expressions (real factors only):

(a)  $x^2 - 3x - 10$

(b)  $2x^4 + 2x^2 - 4$

(c)  $x^3 + 1$

3. (a) Solve the following equations for all real roots:

i.  $|3x + 1| = 2x + 2$

ii.  $\frac{z^2 + 2}{z^2 - 2} = \frac{1}{z^4 - 4z^2 + 4}$

(b) i. What is the solution set satisfying  $|3x + 3| \geq x^2 + x$  ?

ii. If  $y = \frac{5 + 3x}{4x - 2}$  then find  $x$  in terms of  $y$ .

4. Simplify:

(a)  $\frac{1}{x - a} - \frac{1}{x + a}$

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

(c)  $\frac{(ax - 1)(ax + 1)(a^2x^2 + 1)}{a^4x^4 - 1}$

(d)  $((x - b)^{-1} + (x + b)^{-1})^{-1}$

5. True or False. If true, explain why it is true. If false, provide an example illustrating why it is false.

(a)  $\sqrt{a^2 + b^2} = a + b$

(b)  $\frac{a + b}{c + d} = \frac{a}{c} + \frac{b}{d}$

(c)  $\sqrt{a^2} = a$

(d)  $ax^2 + 1 = 0$  has no real solutions

6. Terry rollerblades a distance of  $x$  miles at a rate of 10 miles per hour. A train moving at a velocity of 60 miles per hour covers  $y$  miles in the same time as Terry rollerblades. Find  $y$  in terms of  $x$ .