Pre-Calculus Name: SOLUTIONS Date: Period:

Assignment 2B

Assignment

For each of the following, determine the amount that needs to be added to complete the square. Then use this value to complete the square and factor the expression. (Use fractions when necessary)

1. $x^2 + 22x$

$$x^2 + 22x + 121 = (x + 11)^2$$

2. $x^2 + 5x$

$$x^2 + 5x + \frac{25}{4} = \left(x + \frac{5}{2}\right)^2$$

Complete the square to rewrite the following equations in vertex form. Then find the coordinates of the vertex.

3. $y = x^2 + 12x$

$$y + 36 = x^2 + 12x + 36$$
$$y + 36 = (x + 6)^2$$
$$y = (x + 6)^2 - 36$$
$$Vertex: (-6, -36)$$

4. $y = 4x^2 - 12x$

$$\frac{y}{4} = x^2 - 3x$$
$$\frac{y}{4} + \frac{9}{4} = x^2 - 3x + \frac{9}{4}$$
$$\frac{y}{4} + \frac{9}{4} = \left(x - \frac{3}{2}\right)^2$$
$$\frac{y}{4} = \left(x - \frac{3}{2}\right)^2 - \frac{9}{4}$$
$$y = 4\left(x - \frac{3}{2}\right)^2 - 9$$
$$Vertex: \left(\frac{3}{2}, -9\right)$$

5. $y = 5x^2 + 30x$

$$\frac{y}{5} = x^2 + 6x$$
$$\frac{y}{5} + 9 = x^2 + 6x + 9$$
$$\frac{y}{5} + 9 = (x + 3)^2$$
$$y = 5(x + 3)^2 - 45$$
$$Veretex: (-3, -45)$$

6. $y = x^2 + 5x - 3$

$$y + 3 = x^2 + 5x$$
$$y + 3 + \frac{25}{4} = \left(x + \frac{5}{2}\right)^2$$
$$y = \left(x + \frac{5}{2}\right)^2 - \frac{37}{4}$$
$$Vertex: \left(-\frac{5}{2}, -\frac{37}{4}\right)$$

7. $y = -2x^2 + 3x - 5$

Axis of symmetry $x = \frac{-(3)}{2(-2)} = \frac{3}{4}$

$$y = -2\left(\frac{3}{4}\right)^2 + 3\left(\frac{3}{4}\right) - 5$$
$$y = -\frac{18}{16} + \frac{9}{4} - 5$$
$$y = -\frac{31}{8}$$
$$Vertex: \left(\frac{3}{4} - \frac{31}{8}\right)$$

(Side note: Here is how you find the vertex by completing the square)

$$\frac{y+5}{-2} = x^2 - \frac{3}{2}x$$
$$\frac{y+5}{-2} + \frac{9}{16} = \left(x - \frac{3}{4}\right)^2$$
$$y + 5 = -2\left(x - \frac{3}{4}\right)^2 + \frac{9}{8}$$
$$y = -2\left(x - \frac{3}{4}\right)^2 - \frac{31}{8}$$
$$Vertex: \left(\frac{3}{4} - \frac{31}{8}\right)$$

8. $y = 5x^2 + x - 22$

Axis of symmetry $x = -\frac{1}{2(5)} = -\frac{1}{10}$

$$y = 5\left(-\frac{1}{10}\right)^2 + \left(-\frac{1}{10}\right) - 22$$
$$y = \frac{5}{100} - \frac{10}{100} - \frac{2200}{100}$$
$$y = -\frac{2205}{100} = \left(-\frac{441}{20}\right)$$
$$Vertex: \left(-\frac{1}{10}, -\frac{441}{20}\right)$$

(Side note: Here is how you find the vertex by completing the square)

$$\frac{y+22}{5} = x^2 + \frac{1}{5}x$$
$$\frac{y+22}{5} + \frac{1}{100} = x^2 + \frac{1}{5}x + \frac{1}{100}$$
$$\frac{y+22}{5} + \frac{1}{100} = \left(x + \frac{1}{10}\right)^2$$
$$\frac{y+22}{5} = \left(x + \frac{1}{10}\right)^2 - \frac{1}{100}$$
$$y + 22 = 5\left(x + \frac{1}{10}\right)^2 - \frac{1}{20}$$
$$y = 5\left(x + \frac{1}{10}\right)^2 - 22\frac{1}{20}$$
$$Vertex: \left(-\frac{1}{10}, -22\frac{1}{20}\right)$$

9. Suppose we take the parabola $y = x^2$ and we move it 5 units up, 6 units left, and flip it upside down. Find the standard form equation of the new parabola.

$$y = -(x+6)^2 + 5$$
$$y = -(x^2 + 12x + 36) + 5$$
$$y = -x^2 - 12x - 36 + 5$$
$$y = -x^2 - 12x - 31$$