MCF3M

QUADRATIC FUNCTIONS
STANDARD, FACTORED & VERTEX FORMS
REVIEW

Standard and Factored Form

1. Write the following in **Standard Form: (2 marks each)**

a. $f(x) = (4x + 1)(3x - 2)$

$= 12x^2 - 8x + 3x - 2$

$= 12x^2 - 5x - 2$

b. $f(x) = -2(x + 5)^2 + 13$

$= -2(x^2 + 10x + 25) + 13$

$= -2x^2 - 20x - 50 + 13$

$= -2x^2 - 20x - 37$

2. Write the following in **Factored Form: (2 marks each)**

a. $f(x) = 4x^2 - 25$

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

b. $g(x) = (8x - 1)(3x - 10)$

$= 24x^2 - 80x - 3x + 10$

$= 24x^2 - 83x + 10$

3. Find the roots of the equation (use any method). **(10 marks)**

a. $x^2 - 13x + 22 = 0$

$-11x - 2$

$(x - 11)(x - 2)$

$x = 11 \quad x = 2$

b. $2x^2 + 18 = 12x$

$2x^2 - 12x + 18 = 0$

$2(x^2 - 6x + 9) = 0$

$2(x - 3)(x - 3) = 0$

$x = 3$

c. $2 + 7x = 4x^2$

$4x^2 - 7x - 2 = 0$

$4x^2 - 8x + 1x - 2 = 0$

$4x(x - 2) + 1(x - 2) = 0$

$(x - 2)(4x + 1) = 0$

$x = 2$

$x = -\frac{1}{4}$

-8 / \ $-8 + 1$ / \ -7

d. $x^2 + 4x - 45 = 0$

$(x + 9)(x - 5)$

$x = -9$

$x = 5$

-45 / \ $+9 \quad -5$

e. $4x^2 - 6x + 9 = 0$

$a = 4$

$b = -6$

$c = 9$

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

$= \frac{6 \pm \sqrt{36 - 144}}{8}$

no roots

f. $4x^2 - 64$

$(2x - 8)(2x + 8) = 0$

$2x - 8 = 0$

$2x = 8$

$x = 4$

$2x + 8 = 0$

$x = -4$

or $x = -4$

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$y = a(x-h)^2 + k$

(h, k)

Standard and Vertex Form

1. For each quadratic function: **(3 marks each)**
   a. Identify the coordinates of the vertex
   b. State whether this value is a maximum or a minimum
   c. State the x value where this maximum and minimum occurs

a. $y = (x+4)^2 - 3$ $(-4, -3)$ min. $x = -4$

b. $-\frac{1}{2}(x-6)^3 - 1$ $(6, -1)$ max. $x = 6$

b. $y = 7x^2$

$y = 7(x-0)^2 + 0$

$(0, 0)$ min. $x = 0$

2. Write each quadratic function in the form $y - a(x-h)^2 + k$ **(3 marks each)**
   a. $y = x^2 - 8x + 19$

$y = (x^2 - 8x + 16 - 16) + 19$

$y = (x-4)^2 + 19 - 16$

$y = (x-4)^2 + 3$

b. $y = 3x^2 - 12x + 40$

$y = 3(x^2 - 4x + 4 - 4) + 40$

$= 3(x^2 - 4x + 4) - 12 + 40$

$= 3(x-2)^2 + 28$

c. $y = -\frac{1}{2}x^2 + 8x - 6$

$y = -\frac{1}{2}(x^2 + 16x + 64 - 64) - 6$

$= -\frac{1}{2}(x^2 - 16 + 64) + 32 - 6$

$= -\frac{1}{2}(x-8)^2 + 26$

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$b^2 - 4ac$

4. **Without finding the roots**, determine the value of the discriminant and classify each of the equations as having one of the following:

-2 *equal* real roots
-2 different real roots
-No real roots

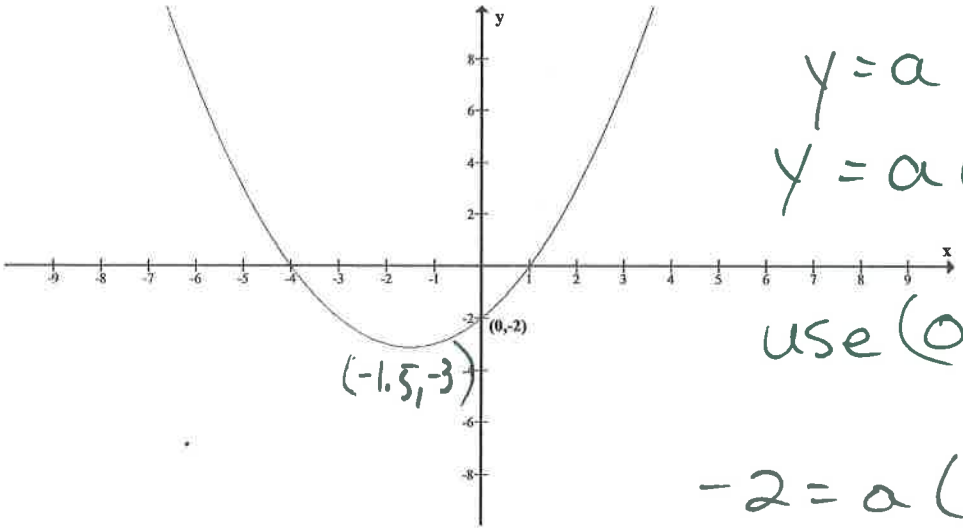
a. $x^2 - 2x + 23 = 0$
b. $5x^2 - 6x + 1 = 0$
c. $3x^2 - 7x + 10 = 0$

a) $b^2 - 4ac$
$= (-2)^2 - 4(1)(23)$
$= 4 - 92$
$= -$
No roots

b) $(-6)^2 - 4(5)(1)$
$= 36 - 20$
$= 16$
$\therefore$ 2 real roots

c) $(-7)^2 - 4(3)(10)$
$= 49 - 120$
$= -71$ $\therefore$ no roots

5. Determine the equation of the parabola. **(4 marks)**



$y = a(x-h)^2 + k$
$y = a(x+1.5)^2 - 3$

use (0,-2) to solve for "a"

$-2 = a(0+1.5)^2 - 3$
$-2 = a(1.5)^2 - 3$
$-2 = a(2.25) - 3$
$-2 + 3 = 2.25a$
$+1 = 2.25a$
$a = 0.44$

$\therefore$ $y = 0.44(x+1.5)^2 - 3$

6. Determine the i) Roots, ii) Axis of symmetry, and iii) Vertex for $f(x) = x^2 - 7x + 12$. **(5 marks)**

12
1 1
-3 -4

$(x-3)(x-4)$

i) $x = 3$ $x = 4$

ii) $\frac{3+4}{2} = \frac{7}{2}$

iii) Vertex $y = \left(\frac{7}{2}\right)^2 - 7\left(\frac{7}{2}\right) + 12$
$= 12.25 - 24.5 + 12 = -0.25$

$\left(\frac{7}{2}, -0.25\right)$ $(3.5, -0.25)$

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3. Solve each equation using the quadratic formula. **(2 marks each)**

a. $a^2 - 7a + 12 = 0$

$$x = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(12)}}{2(1)}$$

$$= \frac{7 \pm \sqrt{1}}{2}$$

$$= \frac{7+1}{2} \quad = \frac{7-1}{2}$$

$$x = 4 \quad x = 3$$

b. $6x^2 = 5x + 1$

$$6x^2 - 5x - 1 = 0$$

$$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(6)(-1)}}{2(6)}$$

$$= \frac{5 \pm \sqrt{25+24}}{12}$$

$$= \frac{5+\sqrt{49}}{12} \quad = \frac{5-\sqrt{49}}{12}$$

$$= \frac{5+7}{12} \quad = \frac{5-7}{12}$$

$$= 1 \quad = \frac{-1}{6}$$