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

$= -2(x + 5)(x + 5) + 13$

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

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

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

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

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

already in factored form

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

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

$f(x) = (x - 11)(x - 2)$

$x = 11 \quad x = 2$

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

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

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

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

$x = 3 \quad x = 3$

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

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

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

$x = 0.25 \quad x = -2$

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

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

$x = 5 \quad x = -9$

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

$(4x^2 - 6x) + 9$

$(4x^2 - 6x + 9 - 9) + 9$

$(4x^2 - 6x + 9) + 0$

$(2x - 3)^2$

$(3, 0)$ No roots ☺

f. $4x^2 - 64$

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

$x = 4 \quad x = -4$

$(x+0)(1x-0)$

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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. $y = (x+4)^2 - 3$
Vertex: $(-4, -3)$
Minimum
(-4)

b. $y = 7x^2$
vertex: $(0, 0)$
Minimum
$X = (0)$

c. $-\frac{1}{2}(x-6)^3 - 1$
Vertex: $(6, -1)$
Maximum
$X = (6)$

$a = 8$
$m = 19$

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

a. $y = x^2 - 8x + 19$ completing the square

$= (x^2 - 8x) + 19$
$= (x^2 - 8x + 16 - 16) + 19$
$= (x^2 - 8x + 16) + 3$
$= (x-4)^2 + 3$

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

$= 3(x^2 - 4x) + 40$
$= 3(x^2 - 4x + 4 - 4) + 40$
$= 3(x^2 - 4x + 4) + 28$
$= 3(x-2)^2 + 28$

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

$= -\frac{1}{2}(x^2 - 4x) - 6$
$= -\frac{1}{2}(x^2 - 4x + 4 - 4) - 6$
$= -\frac{1}{2}(x^2 - 4x - 4) - 4$
$= -\frac{1}{2}(x-2)^2 - 4$

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$a = 1 \quad b = -7 \quad c = 12$

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

a. $a^2 - 7a + 12 = 0$ b. $6x^2 = 5x + 1$

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

$x = \dfrac{7 \pm \sqrt{49 - 48}}{2}$

$x = \dfrac{7 \pm \sqrt{1}}{2}$

$= \dfrac{7 \pm 1}{2}$

$x = \dfrac{7 + 1}{2} \qquad x = \dfrac{7 - 1}{2}$

$= 4 \qquad = 3$

b) $6x^2 - 5x - 1$

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

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

$= \dfrac{5 \pm \sqrt{49}}{12}$

$x = \dfrac{5 + 7}{12} \qquad x = \dfrac{5 - 7}{12}$

$= 1 \qquad = -0.16$

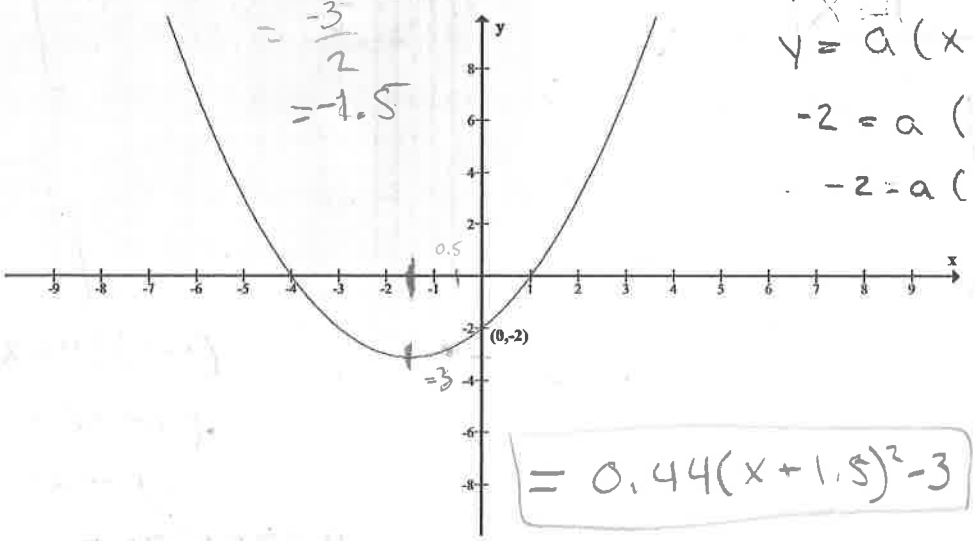
4. **Without finding the roots**, determine the value of the discriminant and classify each of the equations as having one of the following:
   -2 *equal* real roots
   -2 different real roots
   -No real roots
   a. $x^2 - 2x + 23 = 0$
   b. $5x^2 - 6x + 1 = 0$
   c. $3x^2 - 7x + 10 = 0$

a) $b^2 - 4ac$
$(-2)^2 - 4(1)(23)$
$= 4 - 92$
$= -88$
no roots

b) $b^2 - 4ac$
$= 36 - 20$
$= 16$ → 2 roots

c) $= b^2 - 4ac$
$= (7)^2 - 4(3)(10)$
$= 49 - 120$ ← no roots
$= -71$

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



$= \frac{-4 \pm 1}{2}$
$= \frac{-3}{2}$
$= -1.5$

$y = a(x-h)^2 + k$
$y = a(x+1.5)^2$
$-2 = a(0+1.5)^2 - 3$
$-2 = a(1.5)^2 - 3$
$-2 = a(2.25) - 3$
$3 - 2 = 2.25a$
$\frac{1}{2.25} = \frac{2.25a}{2.25}$
$0.44 = a$

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

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

-7
-3
-4 | 12

$(x-3)(x-4)$
roots $x = 3$ $x = 4$

$\frac{3+4}{2}$
AOS → $x = 3.5$

$3.5^2 - 7(3.5) + 12$
$12.25 - 24.5 + 12$
$y = -0.75$
∴ the vertex is $(3.5, -0.75)$