Name: SOLUTIONS

Chapter 3 – Section 3.1 Introduction to the Family of Quadratic Functions

TICKET-IN-THE-DOOR

In order to be prepared for class you must watch the module and complete the following activity. This is due first thing when you get to class.

Write the two general forms for quadratic function

- Standard Form $f(x) = ax^2 + bx + c$
- Factored form $f(x) = a(x - r_1)(x - r_2)$ where r_1 & r_2 are the zeros (x-intercepts)

Write the quadratic formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Check your understanding:

Find the zeros to the following quadratics functions

1. $Q(r) = 5r - 6 + r^2$

Sol. $0 = r^2 + 5r - 6$

$0 = (r+6)(r-1)$

$r + 6 = 0$ or $r - 1 = 0$

$\boxed{r = -6}$ $\boxed{r = 1}$

2. $y = 4x^2 + 57x + 14$

Sol. $0 = (4x^2 + 56x) + (x + 14)$

$0 = 4x(x+14) + 1(x+14)$

$0 = (x+14)(4x+1)$

$x + 14 = 0$ or $4x + 1 = 0$

$\boxed{x = -14}$ $\boxed{x = -1/4}$

3. $F(x) = 2.4x^2 + 4.2x + 1.2$

Sol. $0 = 2.4x^2 + 4.2x + 1.2$

$x = \dfrac{-4.2 \pm \sqrt{(4.2)^2 - 4(2.4)(1.2)}}{2(2.4)}$

$x = \dfrac{-4.2 \pm 2.47}{4.8}$

$\boxed{x = -0.37}$

$\boxed{x = -1.39}$

4. The **height of an object** above the ground is described by the function $f(t) = 2.7t^2 - 13t + 5$.

a) What is the initial height of the object at time $t = 0$? Sol. $f(0) = 2.7(0)^2 - 13(0) + 5 = \boxed{5}$

b) When does the object have **height** 3?

Sol. $f(t) = 2.7t^2 - 13t + 5$

$3 = 2.7t^2 - 13t + 5$

$2.7t^2 - 13t + 2 = 0$

$t = \dfrac{13 \pm \sqrt{(13)^2 - 4(2.7)(2)}}{2(2.7)}$

$t = \dfrac{13 \pm 12.14}{5.4}$

$\boxed{t = 4.66}$

$\boxed{t = 0.16}$

5. Find a quadratic equation, f, with zeros at $x = 4$ and $x = -3$ such that $f(1) = 24$.

Sol. $f(x) = a(x - r_1)(x - r_2)$

$f(x) = a(x-4)(x-(-3))$

$f(x) = a(x-4)(x+3)$

$24 = a(1-4)(1+3)$

$24 = a(-3)(4)$

$a = -2$

$\boxed{f(x) = -2(x-4)(x+3)}$

Super fun! Suppose $g(x) = 3x^2 - 5x$. What is $\dfrac{g(x+h) - g(x)}{h}$

Sol. $\dfrac{g(x+h) - g(x)}{h} = \dfrac{3(x+h)^2 - 5(x+h) - (3x^2 - 5x)}{h}$

$= \dfrac{3(x^2 + 2xh + h^2) - 5(x+h) - (3x^2 - 5x)}{h}$

$= \dfrac{\cancel{3x^2} + 6xh + 3h^2 - \cancel{5x} - 5h - \cancel{3x^2} + \cancel{5x}}{h}$

$= \dfrac{\cancel{h}(6x + 3h - 5)}{\cancel{h}}$

$\boxed{= 6x + 3h - 5}$

Section 3.1 Introduction to the Family of Quadratic Functions

3.1

Name: SOLUTIONS

TICKET-IN-THE-DOOR

In order to be prepared for class you must watch the module and complete the following activity. This is due first thing when you get to class.

Check your understanding:

1. Convert the function $f(x)=x^2+2x+10$ into vertex form, $f(x)=a(x-h)^2+k$, by completing the square.

Sol: $f(x)=x^2+2x+10$

$f(x)=x^2+2x+1 \quad +10-1$

$f(x)=(x+1)^2+9$

$\boxed{\text{Vertex: } (-1,9)}$

2. Convert the function $f(x)=-4x^2-12x-8$ into vertex form, $f(x)=a(x-h)^2+k$, by completing the square.

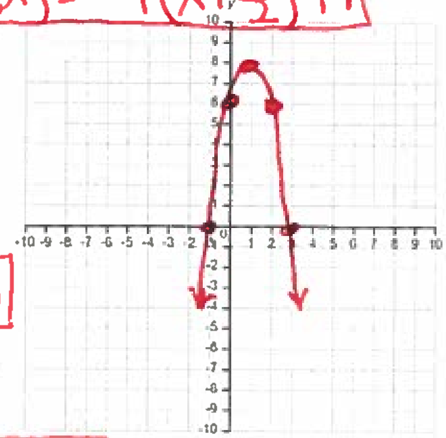
$f(x)=-4x^2-12x-8$

$f(x)=-4\left[\left(x^2+3x+\frac{9}{4}\right)+\frac{2}{1}\cdot\frac{4}{4}-\frac{9}{4}\right]$

$f(x)=-4\left[\left(x+\frac{3}{2}\right)^2-\frac{1}{4}\right]$

$\boxed{f(x)=-4\left(x+\frac{3}{2}\right)^2+1}$

3. For the quadratic function $y = -2x^2 +4x +6$ determine:



a. whether the parabola concave up or down

Sol: CONCAVE DOWN; $a=-2<0$

b. the vertical intercept (y-intercept)

Sol: $y=-2(0)^2+4(0)+6 \Rightarrow y=6 \Rightarrow \boxed{(0,6)}$

c. the coordinates of its vertex

Sol: $y=-2(x^2-2x+1 \quad -3-1)$

$y=-2((x-1)^2-4) \Rightarrow y=-2(x-1)^2+8$

$\boxed{\text{VERTEX: } (1,8)}$

d. the equation of the axis of symmetry,

Sol: $x=1$

e. Graph (You must have at least 5 points)

Sol: See graph

$0=-2(x-1)^2+8$

$4=(x-1)^2$

$\pm 2=x-1$

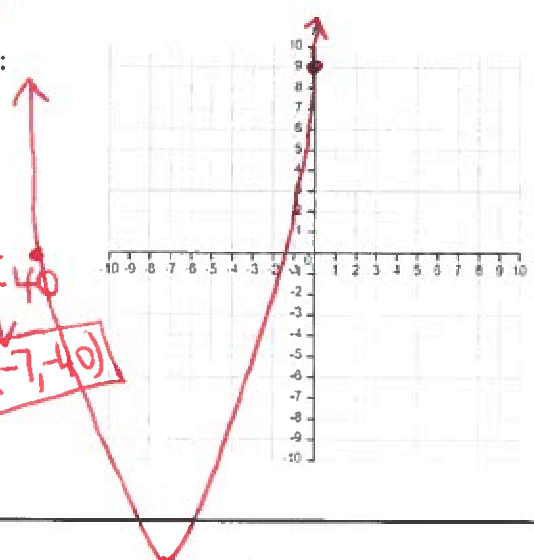
$x-1=2$

$\boxed{x=3}$

$x-1=-2$

$\boxed{x=-1}$

4. For the quadratic function $y = x^2+14x+9$ determine:



(-7,-40)

a. whether the parabola concave up or down

Sol: CONCAVE UP; $a=1>0$

b. the vertical intercept (y-intercept)

Sol: $y=0^2+14(0)+9=9 \Rightarrow (0,9)$

c. the coordinates of its vertex

Sol: $y=(x^2+14x+49)+9-49=(x+7)^2-40$

$\boxed{(-7,-40)}$

d. the equation of the axis of symmetry,

Sol: $x=-7$

e. Graph (You must have at least 5 points)

Sol: See graph