***Pre-Calculus 11***

***Unit 4: Analyzing Quadratic Functions***

***Worksheet 4.1—Properties of a Quadratic Function***

1. Is each function a quadratic function?
2. $y=3x^{2}+7x-2$ b) $f\left(x\right)=x^{2}+\sqrt{x}$ c) $f\left(x\right)=25-9x^{2}$

d) $y=7-5x^{2}$ e) $y=2x^{2}+11x-4$ f) $f\left(x\right)=\frac{1}{4x^{2}-9x+12}$

1. What is the difference between the "roots of the equation" and the "zeros of the equation"? Where are each found on the graph of the quadratic function?
2. For each of the following quadratic functions, determine the following:

i) the *y*-intercept of the graph

ii) whether the vertex of the graph is a maximum or minimum point

1. $f\left(x\right)=\frac{1}{2}x^{2}+4x-2$ b) $y=5x-8-3x^{2}$

c) $ y=1.5x-3x^{2}+5$ d) $f\left(x\right)=10-7x+x^{2}$

1. For each of the graphs below, determine the following characteristics:

i) *y*-intercept of the graph ii) *x*-intercepts of the graph

iii) axis of symmetry iv) vertex

v) domain vi) range



1. b)
2. Use a table of values to graph each quadratic function. Then determine the following characteristics:

i) *y*-intercept of the graph ii) *x*-intercepts of the graph

iii) axis of symmetry iv) vertex

v) domain vi) range

a) $y=x^{2}-4x+3$ b) $y=-2x^{2}+8x-6$

c) $y=x^{2}+4x-5$ d) $y=x^{2}-4$

e) $y=x^{2}+2x+3$ f) $ y=-x^{2}+4x-4$

1. Without graphing, determine the following characteristics of the quadratic functions.

i) *y*-intercept of the graph ii) *x*-intercepts of the graph

iii) axis of symmetry iv) vertex

v) domain vi) range

 a) $y=x^{2}+4x+3$ b) $y=x^{2}+2x+3$

 c) $y=4x^{2}-8x-5$ d) $y=x^{2}-3x$

 e) $y=-x^{2}+4x-4$ f) $y=-x^{2}+4x-3 $

***Solutions***

1. a) yes b) no c) yes d) yes e) yes f) no

2. The roots of the equation are the zeros of the eqution. They are the x-intercepts of the graph.

3. a) i) *y*-intercept$ =-2$ ii) Vertex is a minimum

 b) i) *y*-intercept$ =-8$ ii) Vertex is a maximum

 c) i) *y*-intercept$ =5$ ii) Vertex is a maximum

 d) i) *y*-intercept$ =10$ ii) Vertex is s minimum

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| 4. | i) *y*-intercept | ii) *x*-intercepts | iii) axis of symmetry | iv) vertex | v) domain | vi) range |
| a)  | $$\left(0, 5\right)$$ | $\left(-5, 0\right)$ and $\left(-1, 0\right)$ | $$x=-3$$ | $$\left(-3,-4\right)$$ | $$\left\{x|xϵR\right\}$$ | $$\left\{y|y\geq -4,yϵR\right\}$$ |
| b)  | $$\left(0, -8\right)$$ | $\left(2, 0\right)$ and $\left(4, 0\right)$ | $$x=3$$ | $$\left(3, 1\right)$$ | $$\left\{x|xϵR\right\}$$ | $$\left\{y|y\leq 1,yϵR\right\}$$ |

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| 5. | i) *y*-intercept | ii) *x*-intercepts | iii) axis of symmetry | iv) vertex | v) domain | vi) range |
| a) $$y=x^{2}-4x+3$$ | $$\left(0, 3\right)$$ | $\left(1,0\right)$ and $\left(3,0\right)$ | $$x=2$$ | $$\left(2,-1\right)$$ | $$\left\{x|xϵR\right\}$$ | $$\left\{y|y\geq -1,yϵR\right\}$$ |
| b)  $y=-2x^{2}+8x-6$ | $$\left(0,-6\right)$$ | $\left(1,0\right)$ and $\left(3,0\right)$ | $$x=2$$ | $$\left(2, 2\right)$$ | $$\left\{x|xϵR\right\}$$ | $$\left\{y|y\leq 2,yϵR\right\}$$ |
| c) $$y=x^{2}+4x-5$$ | $$\left(0,-5\right)$$ | $\left(-5,0\right)$ and $\left(1,0\right)$ | $$x=-2$$ | $$\left(-2,-9\right)$$ | $$\left\{x|xϵR\right\}$$ | $$\left\{y|y\geq -9,yϵR\right\}$$ |
| d) $$y=x^{2}-4$$ | $$\left(0,-4\right)$$ | $\left(-2,0\right)$ and $\left(2,0\right)$ | $$x=0$$ | $$\left(0,-4\right)$$ | $$\left\{x|xϵR\right\}$$ | $$\left\{y|y\geq -4,yϵR\right\}$$ |
| e) $y=x^{2}+2x+3$   | $$\left(0, 3\right)$$ | none | $$x=-1$$ | $$\left(-1,2\right)$$ | $$\left\{x|xϵR\right\}$$ | $$\left\{y|y\geq 2,yϵR\right\}$$ |
| f) $$y=-x^{2}+4x-4$$ | $$\left(0,-4\right)$$ | $$\left(2,0\right)$$ | $$x=2$$ | $$\left(2, 0\right)$$ | $$\left\{x|xϵR\right\}$$ | $$\left\{y|y\leq 0,yϵR\right\}$$ |

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| 6. | i) *y*-intercept | ii) *x*-intercepts | iii) axis of symmetry | iv) vertex | v) domain | vi) range |
| a) $y=x^{2}+4x+3$ | $$\left(0, 3\right)$$ | $\left(-3,0\right)$ and $\left(-1,0\right)$ | $$x=-2$$ | $$\left(-2,-1\right)$$ | $$\left\{x|xϵR\right\}$$ | $$\left\{y|y\geq -1,yϵR\right\}$$ |
| b) $y=x^{2}+2x+3$ | $$\left(0, 3\right)$$ | $\left(-2,0\right)$ and $\left(-1,0\right)$ | $$x=-1.5$$ | $$\left(-1.5,-2.25\right)$$ | $$\left\{x|xϵR\right\}$$ | $$\left\{y|y\geq 2.25,yϵR\right\}$$ |
| c) $y=4x^{2}-8x-5$  | $$\left(0, -5\right)$$ | $\left(-0.5,0\right)$ and $\left(2.5,0\right)$ | $$x=1$$ | $$\left(1,-9\right)$$ | $$\left\{x|xϵR\right\}$$ | $$\left\{y|y\geq -9,yϵR\right\}$$ |
| d) $y=x^{2}-3x$ | $$\left(0, 0\right)$$ | $\left(0,0\right)$ and $\left(3,0\right)$ | $$x=1.5$$ | $$\left(0,-2.25\right)$$ | $$\left\{x|xϵR\right\}$$ | $$\left\{y|y\geq 1.5,yϵR\right\}$$ |
| e) $y=-x^{2}+4x-4$  | $$\left(0, -4\right)$$ | $$\left(2,0\right)$$ | $$x=2$$ | $$\left(2,0\right)$$ | $$\left\{x|xϵR\right\}$$ | $$\left\{y|y\leq 0,yϵR\right\}$$ |
| f) $y=-x^{2}+4x-3$ | $$\left(0, -3\right)$$ | $\left(3,0\right)$ and $\left(1,0\right)$ | $$x=2$$ | $$\left(2,1\right)$$ | $$\left\{x|xϵR\right\}$$ | $$\left\{y|y\leq 1,yϵR\right\}$$ |