Math 71 – Summer 2007 Name:

QUIZ #5 @ 30 points

Write in a neat and organized fashion. Write your complete solutions on SEPARATE PAPER. You should use a pencil. For an exercise to be complete there needs to be a detailed solution to the problem. Do not just write down an answer. No proof, no credit given! Clearly label each exercise.

1. Solve by extracting roots: $64(2x+1)^2+9=0$

2. Solve by completing the square: $8x^2+5x-1=0$

3. Solve by the quadratic formula: $4x^2-2x+5=0$

4. Solve the following equation by making an appropriate substitution: $x^4+2x^2-8=0$

5. a) Graph the following function by finding the vertex, and y-and x-intercepts.
b) State the domain and range for each function.

$$f(x)=x^2-2x-15$$

6. a) Graph the following function by finding the vertex, and y-and x-intercepts.
b) State the domain and range for each function.

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

7. When Maria serves in volleyball, the ball leaves her hand with an upward velocity of 20 feet per second. The height "h" of the volleyball above the ground after "t" seconds is given by:

$$h=-16t^2+20t+5.$$

a) If nobody hits the ball, how long will it take the ball to hit the ground?

b) If nobody hits the ball, how long will it take the ball to reach its initial height again?

Quiz #5- SOLUTIONS

(1) $64(2x+1)^2+9=0$

$64(2x+1)^2=-9$

$(2x+1)^2=\frac{-9}{64}$

$\sqrt{(2x+1)^2}=\sqrt{\frac{-9}{64}}$

$2x+1=\pm\frac{3}{8}i$

$2x=-1\pm\frac{3}{8}i \quad /\div 2$

$\boxed{x=\frac{-1}{2}\pm\frac{3}{16}i}$

(2) $8x^2+5x-1=0$

$8x^2+5x=1 \quad /\div 8$

$x^2+\frac{5}{8}x=\frac{1}{8} \quad /+\frac{25}{256}$

$\left(\frac{1}{2}\text{ coefficient } x\right)^2=\left(\frac{1}{2}\cdot\frac{5}{8}\right)^2=\frac{25}{256}$

$x^2+\frac{5}{8}x+\frac{25}{256}=\frac{{}^{32/}1}{8}+\frac{25}{256}$

$\left(x+\frac{5}{16}\right)^2=\frac{32+25}{256}$

$\left(x+\frac{5}{16}\right)^2=\frac{57}{256}$

$\sqrt{\left(x+\frac{5}{16}\right)^2}=\sqrt{\frac{57}{256}}$

$x+\frac{5}{16}=\pm\frac{\sqrt{57}}{16}$

$\boxed{x=\frac{-5}{16}\pm\frac{\sqrt{57}}{16}}$

(3) $4x^2-2x+5=0$

$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a} \qquad \begin{cases} a=4 \\ b=-2 \\ c=5 \end{cases}$

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

$=\frac{2\pm\sqrt{4-80}}{8}=\frac{2\pm\sqrt{-76}}{8}$

$=\frac{2\pm\sqrt{4\cdot 19}\,i}{8}=\frac{2\pm 2\sqrt{19}\,i}{8}$

$=\frac{2(1\pm\sqrt{19}\,i)}{8}=\boxed{\frac{1\pm\sqrt{19}\,i}{4}}$

(4) $x^4+2x^2-8=0$

let $x^2=t$

then $x^4=t^2$

The equation becomes:

$t^2+2t-8=0$

$(t+4)(t-2)=0$

$t=-4$ OR $t=2$

$x^2=-4 \qquad x^2=2$

$\sqrt{x^2}=\sqrt{-4} \qquad \sqrt{x^2}=\sqrt{2}$

$x=\pm 2i \qquad x=\pm\sqrt{2}$

$\boxed{x\in\{2i,-2i,\sqrt{2},-\sqrt{2}\}}$

(5) $f(x) = x^2 - 2x - 15$

parabola opens upward $(a>0)$

Vertex $V(x_v, y_v)$

$x_v = \frac{-b}{2a} = \frac{-(-2)}{2(1)} = 1$

$y_v = 1^2 - 2(1) - 15 = -16$

$\boxed{V(1,-16)}$

y-n: let $x=0$, $y=-15$

$\boxed{y\text{-n}: (0,-15)}$

x-n: let $y=0$, $x^2-2x-15=0$

$(x-5)(x+3)=0$

$x=5$ OR $x=-3$

$\boxed{x\text{-n}: (5,0)\ \&\ (-3,0)}$

Domain: $x \in \mathbb{R}$

Range: $y \in [-16, \infty)$

Graph: See graphing paper.

(6) $f(x) = -x^2 - 2x + 8$

parabola opens downword $(a<0)$

Vertex $V(x_v, y_v)$

$x_v = \frac{-b}{2a} = \frac{-(-2)}{2(-1)} = -1$

$y_v = -(-1)^2 - 2(-1) + 8 = -1+2+8 = 9$

$\boxed{V(-1,9)}$

y-n: let $x=0$, $y=8$

$\boxed{y\text{-n}: (0,8)}$

x-n: let $y=0$

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

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

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

$x=-4$ OR $x=2$

$\boxed{x\text{-n}: (-4,0)\ \&\ (2,0)}$

Domain: $x \in \mathbb{R}$

Range: $y \in (-\infty, 9]$

Graph: See graphing paper

(7) $h = -16t^2 + 20t + 5$

t = time (seconds)

h = height of ball

a) $t=?$ when $h=0$

$-16t^2+20t+5=0 \quad | (-1)$

$16t^2-20t-5=0$

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

$= \frac{-(-20) \pm \sqrt{(-20)^2 - 4(16)(-5)}}{2(16)}$

$= \frac{20 \pm \sqrt{720}}{32}$ — $\frac{20+\sqrt{720}}{32} \approx 1.5$; $\frac{20-\sqrt{720}}{32} < 0$ not possible

The ball will hit the ground after approximately 1.5 seconds.

b) Initial height: $t=0$, $h=5$

$t=?$ when $h=5$

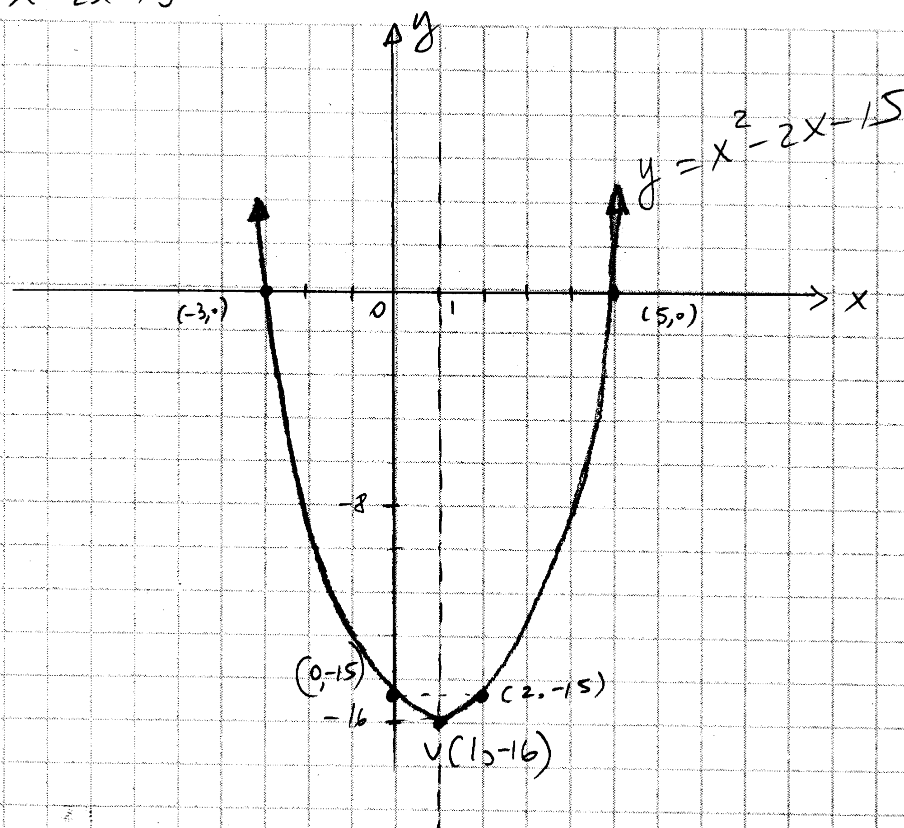
$-16t^2+20t+\cancel{5} = \cancel{5}$

$-16t^2+20t=0$

$4t(-4t+5)=0$ — $t=0$ OR $t=\frac{5}{4}$ seconds

The ball will be at 5 feet after 1.25 seconds.

(5) $f(x) = x^2 - 2x - 15$



(6) $f(x) = -x^2 - 2x + 8$