EAST LOS ANGELES COLLEGE **NAME:** Key

MATHEMATICS 125 TEST CHAPTER 11 --- FALL 2004 (QUADRATIC FUNCTIONS)
INSTRUCTOR: ANNE SISWANTO; TOTAL POINTS: 100; TIME: 70 MINUTES

DIRECTION: GRAPHING CALCULATORS ARE NOT ALLOWED. SHOW ALL WORKS ON THE TEST PAPER FOR FULL CREDIT

QUESTION 1 (15 POINTS)
Solve the following equations by using the METHOD OF COMPLETING THE SQUARES.

a. <7> $x^2+6x+4=0$

$x^2+6x+9 = -4+9$

$(x+3)^2 = 5$ — take square root

$x+3 = \pm\sqrt{5}$

$x = -3\pm\sqrt{5}$

b. <8> $3x^2+7x-2=0$

$\frac{3x^2}{3}+\frac{7x}{3} = \frac{2}{3}$

$x^2+\frac{7}{3}x+\frac{49}{36} = \frac{2}{3}+\frac{49}{36}$

$\left(x+\frac{7}{6}\right)^2 = \frac{24}{36}+\frac{49}{36}$

$\left(x+\frac{7}{6}\right)^2 = \frac{73}{36}$

$x+\frac{7}{6} = \pm\sqrt{\frac{73}{36}}$ — take square root

$x = -\frac{7}{6}\pm\frac{\sqrt{73}}{6}$

$x = \frac{-7\pm\sqrt{73}}{6}$

QUESTION 2 (33 POINTS)
Solve the following equations by FACTORING or using the QUADRATIC FORMULA. Remember to check your answer.

a. <6> $x^2+2=-x$

$x^2+x+2 = 0$

$a=1,\ b=1,\ c=2$

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

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

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

$x = \frac{-1\pm\sqrt{7}\,i}{2}$

b. <8> $x^4 - 10x^2 + 9 = 0$ → let $t = x^2$ → $t^2 = x^4$

$t^2 - 10t + 9 = 0$

$(t-9)(t-1) = 0$

$t = 9$ or $t = 1$

$x^2 = 9$ $\quad$ $x^2 = 1$

$x = \pm 3$ $\quad$ $x = \pm 1$

solution $\quad$ solution

c. <6> $x - 2\sqrt{x} - 6 = 0$ → let $t = \sqrt{x}$ → $t^2 = x$

$t^2 - 2t - 6 = 0$

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

$t = \dfrac{2 \pm \sqrt{4 - 4(1)(-6)}}{2(1)}$

$t = \dfrac{2 \pm \sqrt{28}}{2}$

$t = \dfrac{2 \pm 2\sqrt{7}}{2}$

$t = 1 \pm \sqrt{7}$

$(\sqrt{x})^2 = (1 + \sqrt{7})^2$

$x = 1 + 2\sqrt{7} + (\sqrt{7})^2$

$x = 8 + 2\sqrt{7}$

solution

$\sqrt{x} = 1 - \sqrt{7}$ no solution ✓

d. <6> $x^{-2} - x^{-1} - 6 = 0$ → Let $t = x^{-1}$, $t^2 = x^{-2}$

$t^2 - t - 6 = 0$

$(t-3)(t+2) = 0$

$t = 3$ or $t = -2$

$\frac{1}{x} = 3$ $\quad$ $\frac{1}{x} = -2$

$3x = 1$ $\quad$ $-2x = 1$

$x = \frac{1}{3}$ $\quad$ $x = -\frac{1}{2}$

solution $\quad$ solution

e. <7> $(x^2-7)^2-3(x^2-7)+2=0$ → Let $t = x^2-7$

$t^2 - 3t + 2 = 0$

$(t-2)(t-1) = 0$

$t = 2$ or $t = 1$

$x^2-7=2$ or $x^2-7=1$

$x^2 = 9$ $x^2 = 8$

$x = \pm 3$ $x = \pm\sqrt{8}$

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

solution solution

QUESTION 3 (14 POINTS)

Solve each formula for the indicated letter. Assume that all variables represent nonnegative numbers.

a. <7> $V = 3.5\sqrt{h}$, for h

$(V)^2 = (3.5\sqrt{h})^2$

$\frac{V^2}{12.25} = \frac{12.25h}{12.25}$

$\frac{V^2}{12.25} = h$

b. <7> $a^2+b^2+c^2=d^2$, for c

$c^2 = d^2-a^2-b^2$

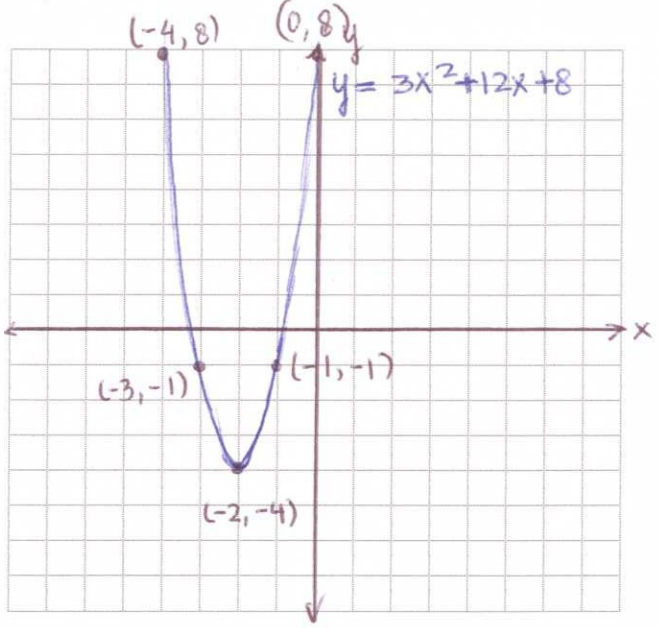
$c = \pm\sqrt{d^2-a^2-b^2}$

QUESTION 4 (8 POINTS)

For the following equation, $y = 3x^2 + 12x + 8$

a. <1> State whether the graph opens upward or downward. Explain your answer.

$a = 3 > 0 \Rightarrow$ so the graph opens up



b. <4> Find the coordinates of the vertex.

$y = 3(x^2 + 4x + 4) + 8 - 12$

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

vertex = $(-2, -4)$

c. <3> Sketch the graph, use at least 5 points. LABEL the points.

x	y	
-4	8	
-3	-1	
-2	-4	← vertex
-1	-1	
0	8	

QUESTION 5 (8 POINTS)

The number of tickets sold each day for an upcoming performance of Handel's Messiah is given by $N(x) = -0.4x^2 + 9x + 11$, where x is the number of days since the concert was first announced. When will daily ticket sales peak and how many tickets will be sold that day?

$N(x) = -0.4x^2 + 9x + 11$

$= -0.4\left(x^2 - \frac{9}{0.4}x \right) + 11$

$= -0.4\,(x^2 - 22.5 + 126.5625) + 11 + 50.625$

$= -0.4\,(x - 11.25)^2 + 61.625$

∴ After 11.25 days, number of tickets sold = 61.625

QUESTION 6 (8 POINTS)

An object is thrown downward from the Sears Tower in Chicago, which is 1454 feet tall. The relationship between the distance s it travels and time t is given by $s = 16t^2$. How long does it take the object to fall freely from the top?

$S = 16t^2$

$\frac{1454}{16} = \frac{16}{16}t^2$

$\frac{1454}{16} = t^2$

$\pm\sqrt{\frac{1454}{16}} = t$

$\pm\sqrt{90.875} = t$

$t = \pm 9.53$

$\therefore$ time = 9.53 s

QUESTION 7 (14 POINTS)

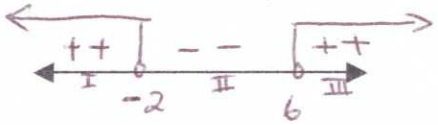
Solve the following inequalities, graph the solution set, and state the **Interval Notation**:

a. <6> $x^2 - 4x > 12$

$x^2 - 4x - 12 > 0$

$(x-6)(x+2) > 0$

$x = 6$ or $x = -2$



$(-\infty, -2) \cup (6, \infty)$

Choose Test Pt:

I : $-3 \rightarrow +$

II : $0 \rightarrow -$

III : $7 \rightarrow +$

b. <8> $\frac{x-1}{x-2} \leq 2$

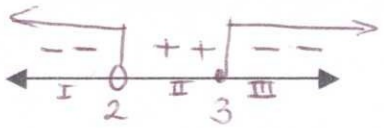
$\frac{x-1}{x-2} - 2 \leq 0$

$\frac{x-1}{x-2} - \frac{2(x-2)}{x-2} \leq 0$

$\frac{x-1-2x+4}{x-2} \leq 0$

$\frac{-x+3}{x-2} \leq 0$

$x = 3$ or $x = 2$



$(-\infty, 2) \cup [3, \infty)$

Test Point : I : $0 \rightarrow -$

II : $2.5 \rightarrow +$

III : $4 \rightarrow -$