Name: Key

Recitation Instructor and Time: ______

Studio College Algebra – Exam 2
March 3, 2009

Directions: There are 16 problems on this exam. Please show all your work.

1. Solve: $x^2 - 6x + 5 = 0$.

$(x-5)(x-1)=0$

$x-5=0$ or $x-1=0$

$\boxed{x=5 \text{ or } x=1}$

Quad Formula

$x = \dfrac{6 \pm \sqrt{36-4(1)(5)}}{2}$

$x = \dfrac{6 \pm \sqrt{16}}{2}$

$x = \dfrac{6 \pm 4}{2}$ $\quad \dfrac{10}{2}$ or $\dfrac{2}{2}$

$\boxed{x = 5 \text{ or } 1}$

2. Write $x^2 + 8x - 15$ in the form $a(x-h)^2 + k$.

$\underbrace{x^2+8x+16}$ $-16-15$

$\boxed{1(x+4)^2 - 31}$

Consider

Or: $x^2 - 2xh + h^2 + k$

where $h^2 + k = -15$ and $-2h = 8$

So, $h = -4$, and $k = -15 - 16$

$k = -31$.

So $\boxed{(x+4)^2 - 31}$ is the solution

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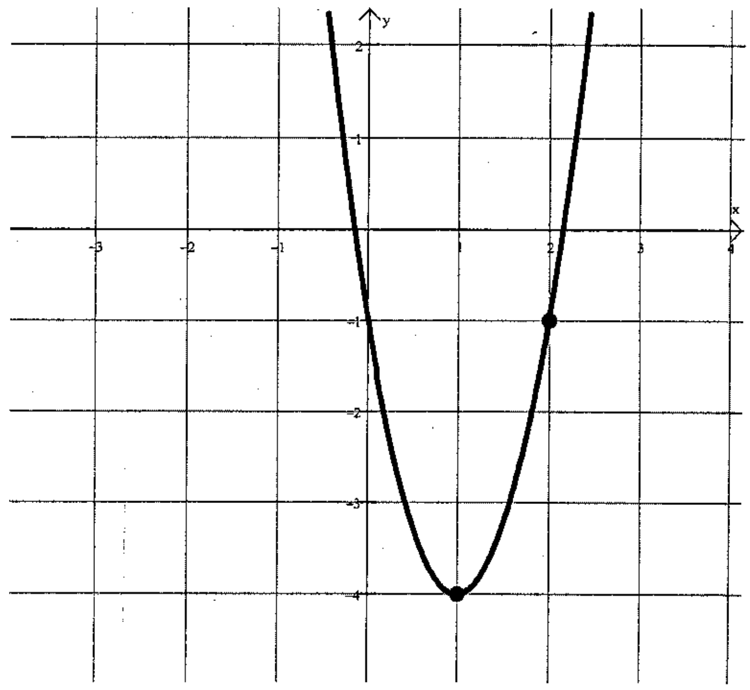
3. The parabola given below has vertex at (1,-4) and passes through the point (2,-1). Find an equation of the parabola in the form $y = ax^2 + bx + c$.



$y = a(x-h)^2 + k$.

$-1 = a(2-1)^2 - 4$

$-1 = a(1) - 4$

$3 = a$

$y = 3(x-1)^2 - 4$

$y = 3(x^2 - 2x + 1) - 4$

$y = 3x^2 - 6x + 3 - 4$

$\boxed{y = 3x^2 - 6x - 1}$

4. If $P(x) = -.3x^2 + 90x + 100$, for what value of x does $P(x)$ attain a maximum value? What is the maximum value?

* max value attained at vertex of the parabola since $a < 0$.

So (h, k) is given by $h = \frac{-b}{2a}$ and $k = P(h)$

$h = \frac{-90}{2(-.3)} = \frac{-90}{-.6} = \boxed{150 \rightarrow \text{x-value at which max is attained}}$

$k = P(150) = -.3(150)^2 + 90(150) + 100$.

$=$ max value

$\boxed{6850}$

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5. Let $f(x) = x^2 + 3x - 2$ and $g(x) = 4x - 1$. Answer the following:

a) Compute $f(x)g(x)$.

$$(x^2+3x-2)(4x-1) = 4x^3+12x^2-8x-x^2-3x+2$$
$$= \boxed{4x^3+11x^2-11x+2}$$

b) Compute $g(f(x))$.

$$g(x^2+3x-2)$$
$$= 4(x^2+3x-2) - 1$$
$$= \boxed{4x^2+12x-9}$$

6. Given $h(x) = 3x^2 + 2x - 5$, find $h(h(2))$.

$$h(2) = 3(2)^2 + 2(2) - 5$$
$$= 12 + 4 - 5$$
$$= 11$$
$$h(h(2)) = h(11) = 3(11)^2 + 2(11) - 5$$
$$= 3(121) + 22 - 5$$
$$= 363 + 22 - 5$$
$$= 385 - 5$$
$$= \boxed{380}$$

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7. Given $f(x) = x^2 - 3$ on the domain $x \geq 0$, find $f^{-1}(x)$.

$y = x^2 - 3$

$x = y^2 - 3$

$x + 3 = y^2$

$\sqrt{x+3} = y$

$\boxed{f^{-1}(x) = \sqrt{x+3}}$

8. Solve: $|x+1| = 5x+7$

$x+1 = 5x+7$ or $x+1 = -5x-7$

$-6 = 4x$ or $6x = -8$

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

$x = -\frac{4}{3}$

Check $x = -\frac{4}{3}$

$\left|-\frac{4}{3}+1\right| = \frac{1}{3}$

$5\left(\frac{-4}{3}\right)+7 = \frac{-20}{3} + \frac{21}{3} = \frac{1}{3}$

$\boxed{x = -\frac{4}{3} \text{ works}}$

Check $x = -\frac{3}{2}$: $\left|\frac{-3}{2}+1\right| = \frac{1}{2}$

$5\left(\frac{-3}{2}\right)+7 = \frac{-15}{2} + \frac{14}{2} = \frac{-1}{2}$

$x = \frac{-3}{2}$ doesn't work

9. Solve: $|2x-9| < 21$

$-21 < 2x-9 < 21$

$-21 < 2x-9$ and $2x-9 < 21$

$-12 < 2x$ and $2x < 30$

$-6 < x$

$x < 15$

$\boxed{-6 < x < 15}$

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10. Solve and check your answers: $x + 4 = \sqrt{x+6}$

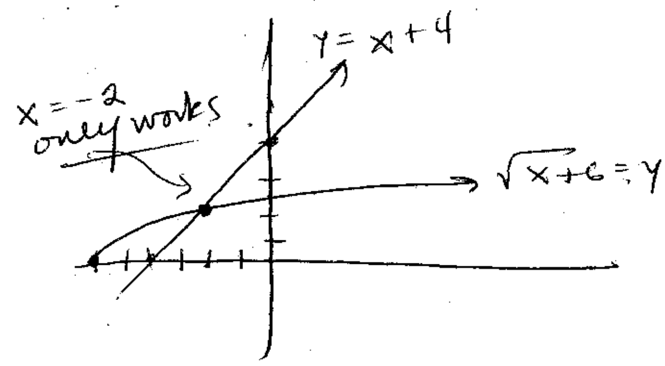
$(x+4)^2 = x+6.$

$x^2 + 8x + 16 = x + 6$

$x^2 + 7x + 10 = 0$

$(x+5)(x+2) = 0.$

$x = -5$ or $\boxed{x = -2}$



graphical way to check.

Check:

$-5 + 4 = -1$

$\sqrt{-5+6} = 1$

$x = -5$ doesn't work

$-2 + 4 = 2$

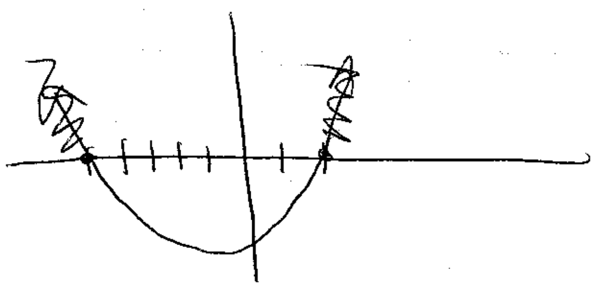
$\sqrt{-2+6} = \sqrt{4} = 2.$

$\boxed{x = -2 \text{ works}}$

11. Solve the quadratic inequality $(x-2)(x+5) > 0$

Zeros of the left side: $x = 2$
$x = -5$

The left side is a parabola that opens upward.



Positive region corresponds to $\boxed{x > 2 \text{ or } x < -5}$

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12. A screen saver starts out as a dot, with a radius expanding at a rate of 5 mm/sec. If the radius of the circle after t seconds is given by $r(t) = 5t$, and the area of the resulting circle is given by $A(r) = 3.14r^2$, answer the following.

a) Find $A(r(t))$, and simplify completely.

$$A(r(t)) = A(5t) = 3.14(5t)^2$$
$$= 25t^2(3.14)$$
$$\boxed{A(r(t)) = 78.5t^2}$$

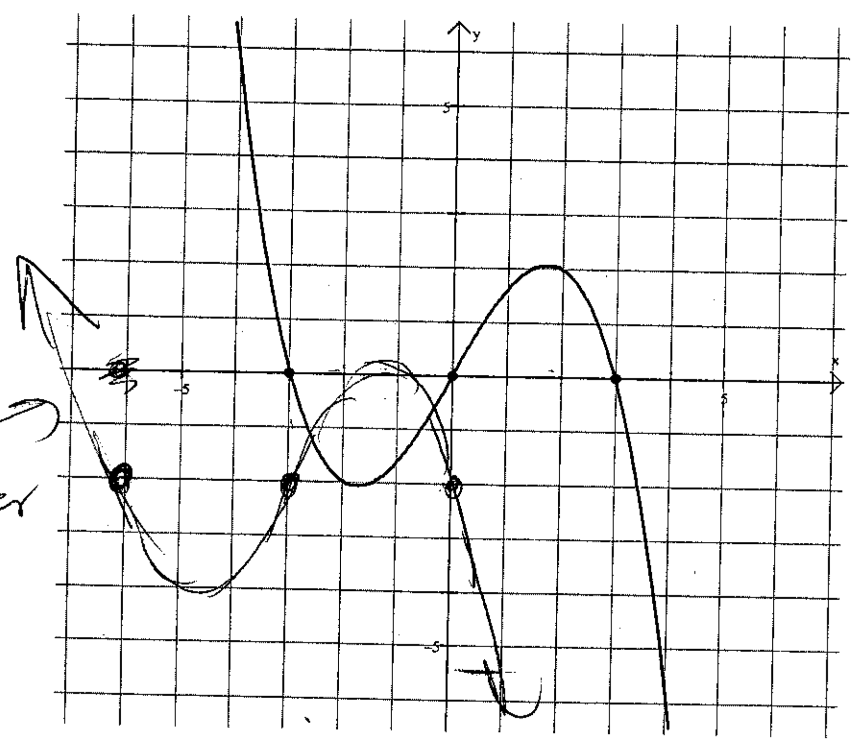
b) Find $A(r(2))$.

$r(2) = 10.$

$$A(10) = 3.14(10)^2$$
$$= 3.14(100)$$
$$= \boxed{314 \text{ square mm.}}$$

13. Given *f(x)* below, graph *f(x+3)-2* on the same set of axes.

answer



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14. The average cost of producing oak bookshelves is $C(x) = 100 + \frac{2500}{x}$, where x is the number of shelves produced per month. What is the average cost per bookshelf if 500 bookshelves are produced?

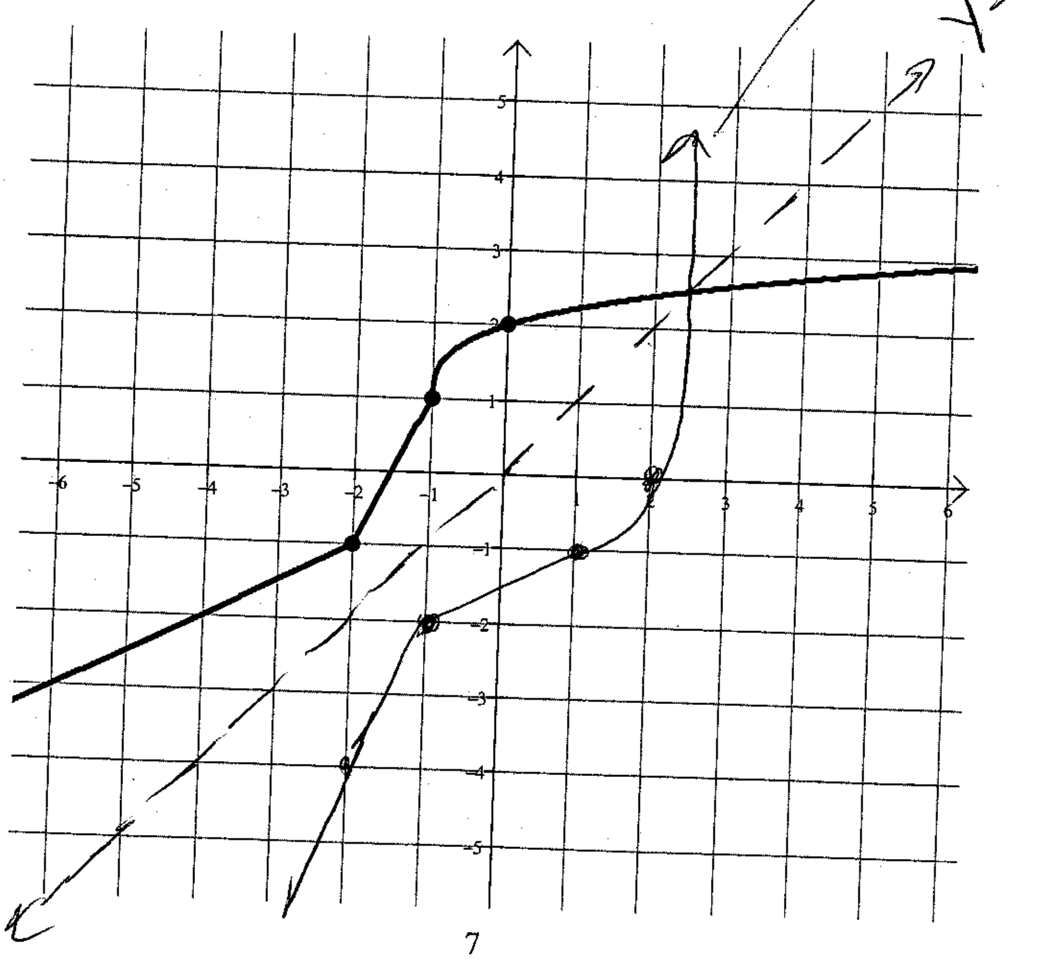
$$C(500) = 100 + \frac{2500}{500}$$

$$= 100 + 5$$

$$= \boxed{\$105}$$

15. Given $f(x)$ below, draw $f^{-1}(x)$ on the same plot.

Reflect over line $y = x$



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16. The following table lists the cost of electricity usage for a certain company:

MONTHLY USAGE (in kilowatt-hours)	MONTHLY CHARGE
0-100	\$10 plus \$0.02 per kilowatt-hour
More than 100, up to 500	\$15 plus \$0.03 for every kilowatt-hour over 100
More than 500, up to 1000	\$20 plus \$0.04 for every kilowatt-hour over 500

a) Construct a piecewise-defined function *C(x)* that describes the cost of monthly usage of kilowatt hours, up to 1000 kilowatt hours.

$$C(x) = \begin{cases} .02x + 10, & 0 \le x \le 100 \\ .03(x-100) + 15 & 100 < x \le 500 \\ .04(x-500) + 20 & 500 < x \le 1000 \end{cases}$$

b) Using your answer in part (a), find *C*(200).

$$\begin{aligned} C(200) &= .03(200-100) + 15 \\ &= .03(100) + 15 \\ &= 3 + 15 \\ &= \boxed{\$18} \end{aligned}$$