

Name: _____

Recitation Instructor and Time: _____

Studio College Algebra – Exam 2
July 2, 2009

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

1. Solve: $x^2 - 13x + 12 = 0$.

$$(x-12)(x-1) = 0$$

$$x-12=0 \text{ or } x-1=0$$

$$\boxed{x=12 \text{ or } x=1}$$

2. Write $x^2 + 8x - 20$ in the form $a(x-h)^2 + k$.

$$x^2 + 8x + 4^2 - 4^2 - 20$$

$$x^2 + 8x + 16 - 16 - 20$$

$$\boxed{(x+4)^2 - 36}$$

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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 $y = ax^2 + bx + c$.

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

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

$$-1 = a - 4$$

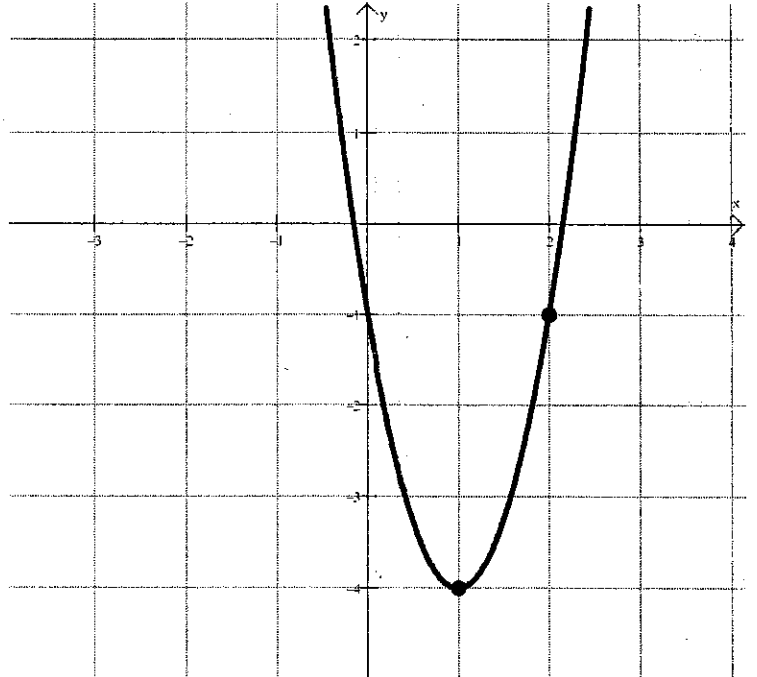
$$a = 3$$

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

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

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

$$y = 3x^2 - 6x - 1$$



4. If $P(x) = 3x^2 + 60x + 100$, for what value of x does $P(x)$ attain a minimum value? What is the ~~maximum~~ value?
minimum

vertex: (h, k)

$$h = \frac{-b}{2a} = \frac{-60}{2(3)} = \frac{-60}{6} = \boxed{-100}$$

$$P(-100) = 3(-100)^2 + 60(-100) + 100$$

$$= 3(10000) - 6000 + 100$$

$$= 30000 - 6000 + 100$$

$$= \boxed{24100} \text{ Max value}$$

5. Let $f(x) = x^2 + 5x - 7$ and $g(x) = 3x - 5$. Answer the following:

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

$$\begin{aligned} (x^2 + 5x - 7)(3x - 5) &= 3x^2 + 15x^2 - 21x \\ &\quad - 5x^2 - 25x + 35 \\ &= \boxed{3x^2 + 10x^2 - 46x + 35} \end{aligned}$$

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

$$\begin{aligned} g(x^2 + 5x - 7) &= 3(x^2 + 5x - 7) - 5 \\ &= 3x^2 + 15x - 21 - 5 \\ &= \boxed{3x^2 + 15x - 26} \end{aligned}$$

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

$$\begin{aligned} h(2) &= 3(2)^2 + 2(2) - 5 \\ &= 12 + 4 - 5 = 11 \end{aligned}$$

$$\begin{aligned} h(11) &= 3(11)^2 + 2(11) - 5 \\ &= 3(\cancel{121}) + 22 - 5 \\ &= 363 + 22 - 5 = \boxed{380} \end{aligned}$$

7. Given $f(x) = x^2 - 10$ on the domain $x \geq 0$, find $f^{-1}(x)$.

$$y = x^2 - 10$$

$$x = y^2 - 10$$

$$x + 10 = y^2$$

$$\sqrt{x+10} = y$$

$$f^{-1}(x) = \sqrt{x+10}, \quad x \geq -10$$

8. Solve: $|x+2| = 8x+7$

$$x+2 = 8x+7$$

$$-5 = 7x$$

$$x = -\frac{5}{7}$$

$$\text{check: } \left| -\frac{5}{7} + 2 \right| = \frac{9}{7} \quad \checkmark$$

$$8\left(-\frac{5}{7}\right) + 7 = \frac{9}{7} \quad \checkmark$$

$$x+2 = -8x-7$$

$$9x = -9$$

$$x = -1$$

Doesn't work.

$$\text{check: } |-1+2| = 1$$

$$8(-1) + 7 = -1$$

9. Solve: $|2x-11| < 25$

$$-25 < 2x-11 < 25$$

$$-25 < 2x-11$$

$$-14 < 2x$$

$$-7 < x$$

and

$$2x < 36$$

$$x < 18$$

$$-7 < x < 18$$

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10. Solve and check your answers: $x = \sqrt{3x-2}$

$$x^2 = 3x - 2$$

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

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

$$x = 2 \text{ or } x = 1$$

Check:

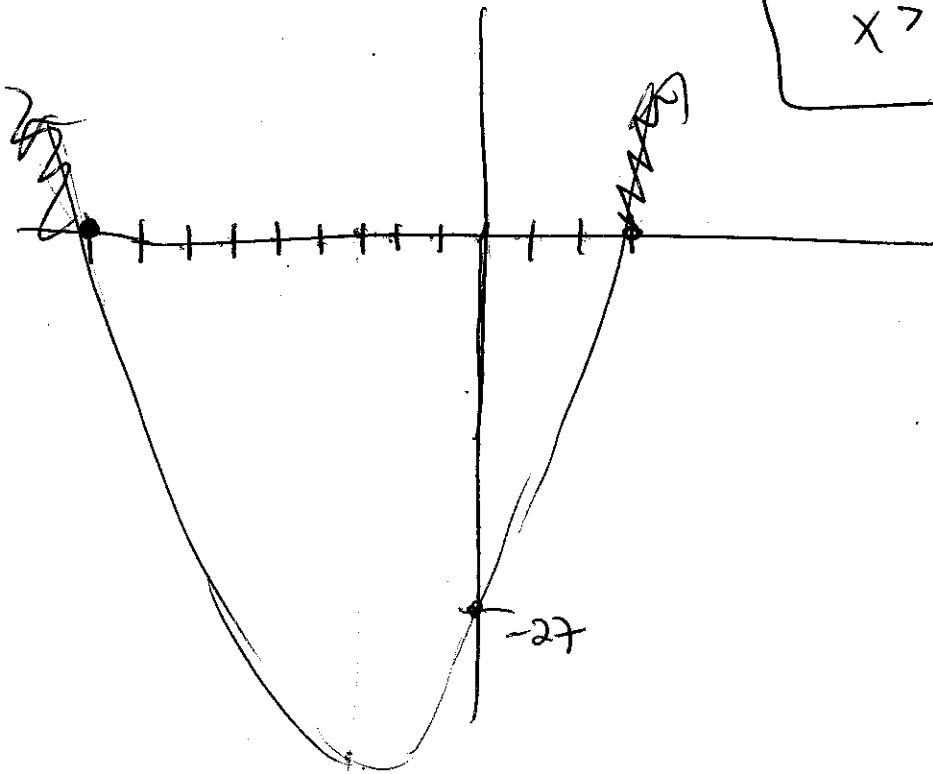
$$x=2: \sqrt{3(2)-2} = \sqrt{4} = 2 \checkmark$$

$$x=1: \sqrt{3(1)-2} = \sqrt{1} = 1 \checkmark$$

Both work.

11. Solve the quadratic inequality $(x-3)(x+9) > 0$

$$x > 3 \text{ or } x < -9$$



12. A screen saver starts out as a dot, with a radius expanding at a rate of 4 mm/sec. If the radius of the circle after t seconds is given by $r(t) = 4t$, and the area of the resulting circle is given by $A(r) = \pi r^2$, answer the following.

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

$$A(4t) = \pi (4t)^2 = 16\pi t^2$$

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

$$r(2) = 8$$

$$A(8) = 64\pi \text{ mm}^2$$

13. Given $f(x)$ below, graph $f(x+1)-2$ on the same set of axes.



left one unit;
down 2
units.

14. The number of on-duty injuries to workers in a certain occupation between the years 1988-1998 is give by $I(x) = 161,488.59x^{-.55}$, with $x=0$ representing 1980.

a) For the year 1995, how many injuries were there?

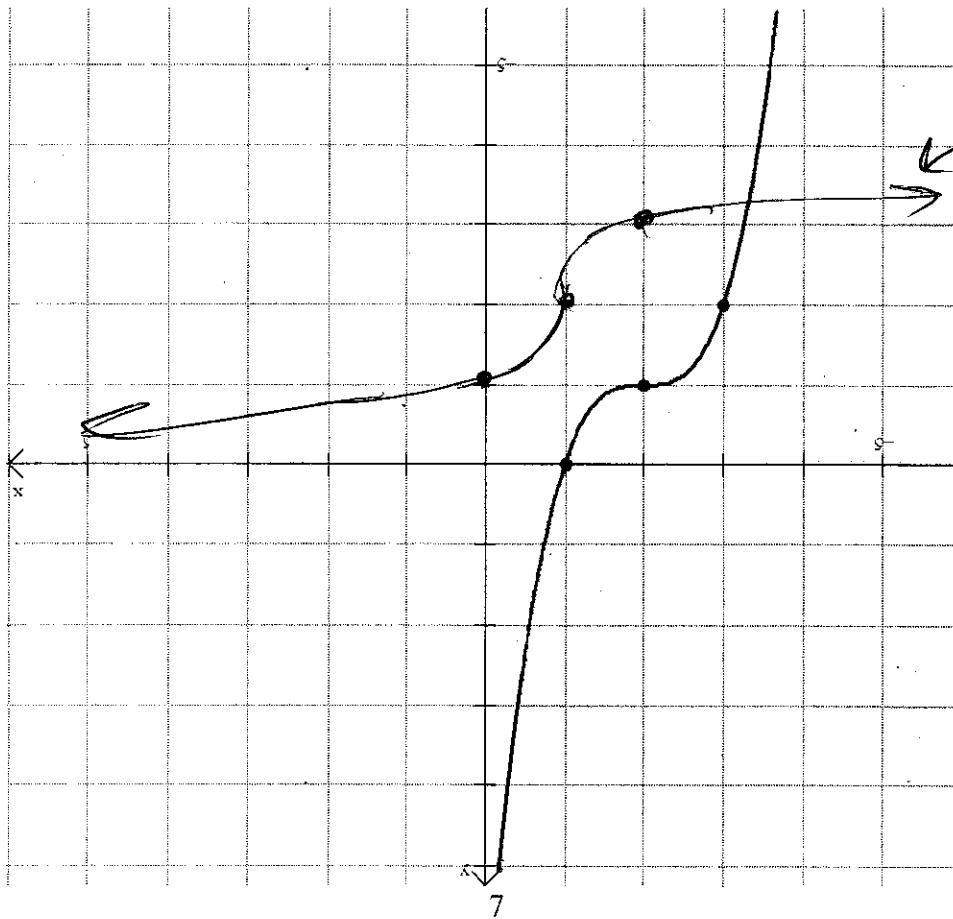
$$I(15) = 161,488.59(15^{-.55}) = 36,415.95$$

Roughly 36,416 injuries.

b) For years after 1995, what is happening to the number of on-duty injuries?

Decreasing, since exponent on x is negative.

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



answer

16. The following table lists the cost of water utilities for a certain company:

Monthly Usage (in gallons)	Monthly Charge
0-200	\$8 plus \$0.05 per gallon
More than 200, up to 1000	\$15 plus \$0.07 for every gallon over 200
More than 1000, up to 1500	\$25 plus \$0.09 for every gallon over 1000

a) Construct a piecewise-defined function $C(x)$ that describes the cost of monthly usage of water, in gallons, up to 1500 gallons.

$$C(x) = \begin{cases} 8 + 0.05x & 0 \leq x \leq 200 \\ 15 + 0.07(x - 200) & 200 < x \leq 1000 \\ 25 + 0.09(x - 1000) & 1000 < x \leq 1500 \end{cases}$$

b) Using your answer in part (a), find $C(1000)$.

$$C(1000) = 15 + 0.07(1000 - 200) \\ = \$71$$