Name: Key
Recitation Instructor:
Recitation Day and Time:

Studio College Algebra – Exam 2 – March 2016

Directions: You will find 16 problems listed below. SHOW ALL WORK!! Each problem is worth 5 points. No notes/books/friends are allowed. Graphing calculator models above the level of a TI-84 plus are not allowed (in particular, calculators with a built in CAS and/or QWERTY keyboard are not allowed). You have one hour to complete this exam.

1. Solve $x^2 - 7x - 11 = 0$.

Quadratic Formula: $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$a = 1,\ b = -7,\ c = -11.$

$x = \frac{7 \pm \sqrt{49 - 4(1)(-11)}}{2(1)}$

$x = \frac{7 \pm \sqrt{49 + 44}}{2} = \boxed{\frac{7 \pm \sqrt{93}}{2}}$

2. Write $x^2 + 16x + 2$ in the form $a(x - h)^2 + k$.

$x^2 + 16x + 2 = x^2 + 16x + 64 - 64 + 2$

$= (x^2 + 16x + 64) - 64 + 2$

$= (x + 8)(x + 8) - 62$

$= \underline{(x + 8)^2 - 62}$

(using vertex formula is fine too).

3. A parabola has vertex at $(-2, 4)$ and passes through the point $(1, 6)$. What is the equation of the parabola? Write your answer in the form $y = a(x - h)^2 + k$ (DO NOT MULTIPLY OUT).

$6 = a(1-(-2))^2 + 4$

$6 = a(3)^2 + 4$

$2 = 9a$

$a = \frac{2}{9}$

Answer: $y = \frac{2}{9}(x+2)^2 + 4$

4. The height of a ball in the air off the ground in meters, t seconds after it is thrown, is given by the equation $s(t) = -4.9t^2 + 12t + 17$. When does the ball hit the ground? (Hint: When the ball hits the ground, what is the distance off the ground? Use this fact, along with the quadratic formula.)

Solve $0 = -4.9t^2 + 12t + 17$

$a = -4.9,\ b = 12,\ c = 17$

$t = \frac{-12 \pm \sqrt{144 - 4(-4.9)(17)}}{2(-4.9)}$

$t = \frac{-12 \pm \sqrt{477.2}}{-9.8}$

$t = -1.005$ seconds or $t \approx 3.454$ seconds

@ $t \approx 3.454$ seconds

5. Given $h(x) = 5x - 4$ and $k(x) = x^2 - 9x$, find $k(x) - h(x)$.

$$K(x) - h(x) = (x^2 - 9x) - (5x - 4)$$
$$= x^2 - 14x + 4$$

6. Given $r(x) = 3x + 1$ and $m(x) = x^3 - 7x$, find $r(x)m(x)$.

$$r(x)m(x) = (3x+1)(x^3 - 7x)$$
$$= 3x^4 - 21x^2 + x^3 - 7x$$
$$= 3x^4 + x^3 - 21x^2 - 7x$$

Either one fine

7. Consider the functions, $f(x) = 8$ and $g(x) = x + 3$:

(a) Using the functions above, find $f(2) + g(2)$.

$f(2) = 8$

$g(2) = 5$

$f(2) + g(2) = 8 + 5 = \boxed{13}$

(b) Using the functions above, find $f(g(f(1)))$.

$f(g(f(1))) = f(g(8))$

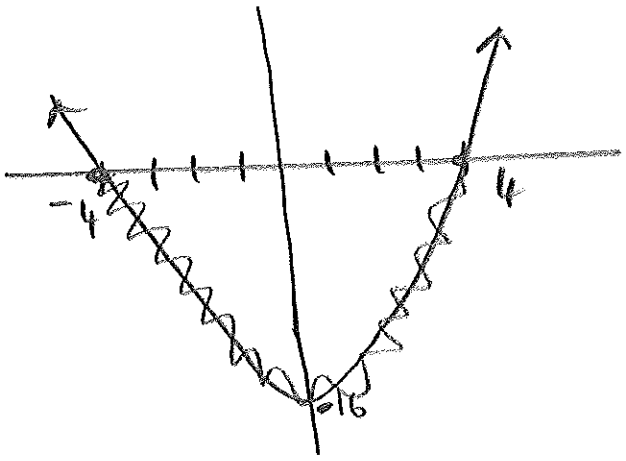
$= f(11)$

$= \boxed{8}$

8. Solve the quadratic inequality $x^2 - 3 < 13$. (Hint: Use either a graphing or number line method discussed in lecture.)

$x^2 - 16 < 0$.

$(x-4)(x+4) < 0$.



Solution: $-4 < x < 4$.

9. Given $f(x) = \dfrac{x-8}{x}$, find $f^{-1}(x)$.

$$y = \frac{x-8}{x}$$

$$xy = x - 8$$

$$xy - x = -8$$

$$x(y-1) = -8$$

$$x = \frac{-8}{y-1}$$

$$f^{-1}(x) = \frac{-8}{x-1}$$

10. Solve and check: $x = \sqrt{x+2}$

$$x^2 = x + 2$$

$$x^2 - x - 2 = 0$$

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

$x = 2$ or $x = -1$.

check $x = -1$:

$-1 \neq \sqrt{-1+2}$

Check $x = 2$:

$2 = \sqrt{2+2}$

Only $x = 2$ works

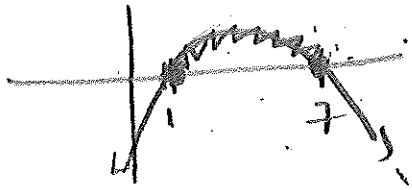
11. The profit function for selling x units of a certain product is given by $P(x) = -x^2 + 8x - 2$, where $P(x)$ is measured in **thousands**. For what number of units will there be at least \$5000 in profit?
Hint: instead of using the number 5000 as part of your calculations, what number should be used?

$-x^2 + 8x - 2 \geq 5$

$-x^2 + 8x - 7 \geq 0$

$-1(x^2 - 8x + 7) \geq 0$

$-1(x-7)(x-1) \geq 0$



$1 \leq x \leq 7$ units.

12. A 3-dimensional cartoon portrays an expanding sphere that grows in volume according to the function $V(r) = \frac{4}{3}\pi r^3$, where r is the radius of the sphere, in millimeters. If the radius grows according to the function $r(t) = 3t$, where t is measured in seconds, find and interpret $V(r(2))$.

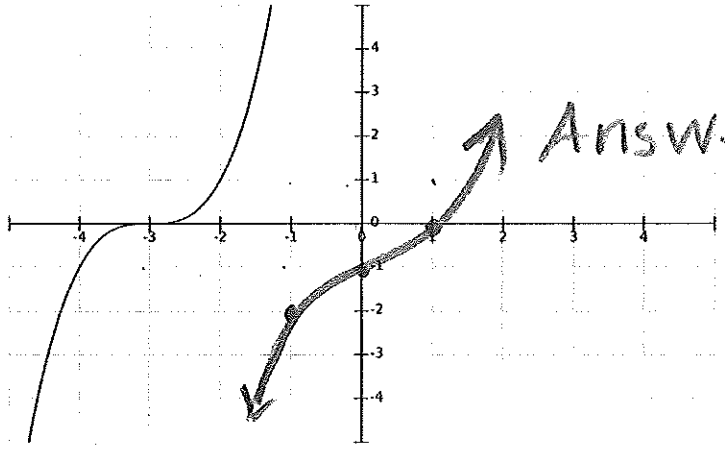
$V(r(2)) = V(6) = \frac{4}{3}\pi(6^3)$

$= \frac{4}{3}\pi(216)$

$= 288\pi \text{ mm}^3$

@ time = 2 seconds, the sphere's volume is 288π mm^3.

13. Given the graph of $f(x)$ below, graph $f(x-3)-1$.



darker grid

14. Insect resting metabolic rate (RMR) has been found to be scaled positively with body mass (M) according to the equation $RMR = 4.14(M^{0.66})$, where M is measured in mg and RMR is measured in mm^3O_2 per hour. Find the RMR of an insect weighing 3.2 grams.

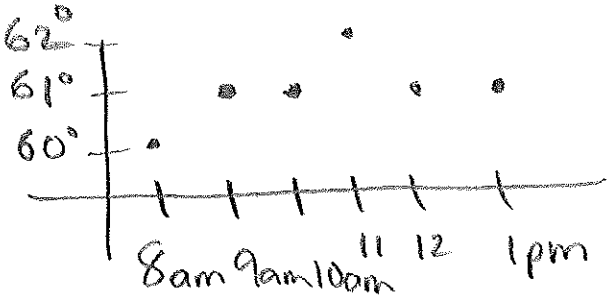
3.2 grams is 3200 mg

$RMR = 4.14(3200^{.66})$

$= 851.9\ mm^3 O_2/hr.$

15. Consider the function whose input value is time of day and whose corresponding output value is temperature at that time of day, rounded to the nearest degree. Is this a one-to-one function? Explain.

No. The temperature could be the same at two different times of day. (the horizontal line test would fail)



Example:

16. Consider the following piecewise function. Write TRUE or FALSE beside each of the statements given below.

$$f(x) = \begin{cases} 5, & x \leq -3 \\ x^3, & -3 < x \leq 2 \\ -x, & x > 2 \end{cases}$$

(a) $f(2) = 8$. True
(b) $f(2) = -2$. False
(c) $f(-3) = 5$. True
(d) $f(-3) = 125$. False
(e) $f(-3) = 3$. False.