Name: KEY ______________________ Student ID#: ________________

Problem Solving (http://goo.gl/rTQmcL)
Essential Academic Skill Enhancement (EASE) workshop series

This workshop reviews the basics of algebra through pre-calculus to help prepare you for college calculus.

We will discuss word problems resulting in:

- Rational Equations
- Radical Equations
- Simple Exponents
- Not-So-Simple Exponents (Logs)
- Quadratic Equations
- Trigonometry
- Composite Functions
- Lines
- Domain & Range

SURVEY
http://goo.gl/4AD3OC

Assessment:

1. Jennifer works part-time at an electronics store and gets paid \$8/hour. During a holiday week, Jennifer will make \$20 just for being an employee (even if she doesn't work). During this week, she can work up to 36 hours. The amount of money she can make during this holiday week is a function of how many hours, h, she works. Find the domain and range of the function. *(Domain and Range)*

   Function: Paid = $P = 8h + 20$

   D: hours worked [0, 36]

   R: plugged in to equation, [20, 308]

2. In your UNM College Algebra class there is a total of 800 possible points. These points come from 10 homework sets that are worth 10 points each, 10 Quizzes worth 10 points each, 4 exams worth 100 points each, and a cumulative final exam worth 200 points. Suppose you have a homework average of 98/100 points, your quiz average is 89/100 points and you have exam grades of 97, 85, 88, and 94. What do you need to get on the final exam to get an A for the course? (Assume an A is 93% or higher of the total possible 800 points). *(Rational Equation)*

   800 pts total; 93 % = A
   10 HW @ 10 pts each = 100 (actual = 98)
   10 Quizzes @ 10 pts each = 100 (actual = 89)
   4 exams @ 100 pts each = 400 (actual = 97+85+88+94)
   1 final @ 200 pts (actual needed to obtain an A in the course = x)

   Desired final grade = HW + Quiz + Exams + Final

   $$800\,(0.93) = 98 + 89 + 364 + x$$

   $$744 = 551 + x$$

   $$193 = x$$

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3. Earthquake intensity is measured by the Richter scale. The formula for the Richter rating of a given quake is given by "$R = \log[I \div I_0]$," where I_0 is the "threshold quake," or movement that can barely be detected, and the intensity I is given in terms of multiples of that threshold intensity.

   You have a seismograph set up at home, and see that there was an event while you were out that had an intensity of I = $989I_0$. Given that a heavy truck rumbling by can cause a microquake with a Richter rating of up to 3.5, and "moderate" quakes have a Richter rating of 4 or more, what was likely the event that occurred while you were out? *(Not-So-Simple Exponents (Logs))*

$$R = \log[I \div I_0]$$

$$= \log[989I_0 \div I_0]$$

$$= \log[989]$$

$$= 2.9951962916$$

   This is not high enough to have been a moderate quake; the event was probably a big truck going too fast over the speed humps in my neighborhood.

4. A baseball is hit and its height in feet, t seconds later, can be approximated by $h = -16t^2 + 40t + 4$. When does the ball hit the ground? (Hint: the height of the ball on the ground is zero; $t = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$)
   (Quadratic equation)
   If h = 0, then we can use the quadratic equation as it is presented above, not additional manipulation necessary.

$$t = \frac{-40 \pm \sqrt{(40)^2 - 4(-16)(4)}}{2(-16)}$$

$$= \frac{-40 \pm \sqrt{1600 - (-256)}}{-32}$$

$$= \frac{-40 \pm \sqrt{1856}}{-32}$$

$$= \frac{-40 \pm 43.08}{-32}$$

$$= \frac{-40+43.08}{-32} \text{ AND } = \frac{-40-43.08}{-32}$$

$$= \frac{-40+43.08}{-32} \text{ AND } = \frac{-40-43.08}{-32}$$

$$= \frac{3.08}{-32} \text{ AND } = \frac{-79.08}{-32}$$

$$= -0.09625 \text{ seconds AND } = 2.47 \text{ seconds}$$

   But, since you can't have negative time, only the **2.47 seconds counts**.

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5. The speed of a tsunami (tidal wave) can travel is modeled by the equation "$S = 356\sqrt{d}$," where S is the speed in kilometers per hour and d is the average depth of the water in kilometers. A tsunami is found to be traveling at 120 kilometers per hour.
What is the average depth of the water? (Round to 3 decimal places.)
Do you think this would pose a major threat to nearby cities? (1 km ≈ 3281 ft; 100 ft ≈ 0.03 km)
(Radical Equations)

$$S = 356\sqrt{d}$$

$$120 = 356\sqrt{d}$$

$$\frac{120}{356} = \sqrt{d}$$

$$(0.33707865168)^2 = \left(\sqrt{d}\right)^2$$

$$(0.337)^2 = d$$

$$0.114 \text{ kilometers} = d$$

This is about 374 ft, so YES, it would cause a huge wall of water crashing in to the city.

6. The pressure p experienced by a diver under water is related to the diver's depth d by an equation of the form $p = kd + 1$ (k a constant). When $d = 0$ meters, the pressure is 1 atmosphere. The pressure at 100 meters is 10.94 atmospheres. Find the pressure at 50 meters. *(Lines)*

$10.94 = k(100) + 1$ ← used 100 and 10.94 to eliminate the issues with $d = 0$

$$9.94 = 100k$$

$$0.0994 = k$$

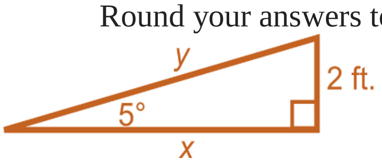
So…

$$p = (0.0994)(50) + 1$$

$$p = 4.97 + 1$$

$$p = 5.97 \text{ atmospheres}$$

7. What if a restaurant needed to build a wheelchair ramp for its customers? The angle of elevation for a ramp is recommended to be 5 degrees. If the vertical distance from the sidewalk to the front door is two feet, what is the horizontal distance that the ramp will take up (x)? How long will the ramp be (y)? Round your answers to the nearest hundredth. *(Trigonometry)*



$\tan(5) = 2/x$	AND	$\sin(5) = 2/y$
$\tan(5)\,(x) = 2$	AND	$\sin(5)(y) = 2$
$x = 2/\tan(5)$	AND	$y = 2/\sin(5)$

$x = 22.86$ ft along the horizon AND $y = 22.95$ ft long ramp

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8. You drink a beverage with 120 mg of caffeine. Each hour, the caffeine in your system decreases by about 12%. How long until you have 10mg of caffeine? The standard equation for rate of growth/decay is: $A = a_o(1 \pm r)^t$; where a_o=the initial amount; r=the percent of increase per time period; t= the number of time periods; and A=the total amount after t time periods. *(Simple Exponents at first glance, Not-So-Simple (Log) upon conducting the problem)*

$$10 = 120\,(1 - 0.12)^t$$

$$10 = 120\,(0.88)^t$$

$$0.0833 = (0.88)^t$$

$$\ln(0.0833) = \ln(0.88^t)$$

$$\ln(0.0833) = t\ln(0.88)$$

$$\ln(0.0833)/\ln(0.88) = t$$

$$\underline{\mathbf{19.44\ hours} = \boldsymbol{t}}$$

9. The number N of bacteria in a refrigerated food is given by: $N(T) = 20T^2 - 80T + 500$, $2 \le T \le 14$, where T is the temperature of the food in degrees Celsius. When the food is removed from the refrigeration, the temperature of the food is given by: $T(t) = 4t + 2$, $0 \le t \le 3$, where t is the time in hours.
Find the time when the bacteria count reaches 2000. *(Composite Functions)*

$N(T(t)) = 20(4t + 2)^2 - 80(4t + 2) + 500$; this gives us the number of bacteria in the food as a function of the amount of time the food as been out of the refrigeration.

$$= 20(16t^2 + 16t + 4) - 320t - 160 + 500$$

$$= 320t^2 + 320t + 80 - 320t - 160 + 500$$

$$= 320t^2 + 420$$

Now to find the actual time: $2000 = 320t^2 + 420$, solve for t.

$$1580 = 320t^2$$

$$4.9375 = t^2$$

$$\underline{\mathbf{2.22\ hrs} = \boldsymbol{t}}$$

Note: we ignore the negative option, since time cannot be negative, and, it is not within the domain of the composite function.