All answers should be exact whenever possible, unless told otherwise.
Approximated answers should be rounded to two decimal places.

1. Give the domain over which each statement is true.

   a) $|x| = x$ b) $|x| = -x$ c) $\sqrt{x^2} = |x|$

   d) $\sqrt{x^2} = -x$ e) $\sqrt{x} > x$ f) $\log_5 x < 0$

2. If $f(x) = x^2 - 4x - 3$ and $g(x) = x - 3$ find

   a) $f \circ g(x)$ b) $f \circ g^{-1}(7)$ c) Values of x where $f(x) > g(x)$

For problems 3 – 7, graph each function and label <u>at least</u> 3 specific points, including intercepts and any other important points. Give the domain and range.

3. $A(x) = |x - 3| + 2$

4. $B(x) = -2(x-3)^2 + 5$

5. $D(x) = \log_2 \ x^2 - x - 12$

6. $C(x) = \left(\frac{2}{3}\right)^x$

7. In calculus it is often handy to have exponential functions written as a power of *e*. The half life formula states: $A_t = A_0\left(\frac{1}{2}\right)^{t/h}$ where A_t is amount after time *t*, A_0 is initial amount, *h* is the half life, and *t* is time. So if a substance has a half life of 2.4 hr, we get $A_t = A_0\left(\frac{1}{2}\right)^{t/2.4}$. Convert this formula to one in which the base is *e* and not $\frac{1}{2}$. Give answer to three decimal places in your exponent approximation.

8. If a red six-sided die and a blue six-sided die are tossed, what is the probability that,
   a) the red comes up with a 2 or a 4 and the blue with an odd number?
   b) that one of the dice comes up with a 2 or a 4 and the other with an odd number?
   c) that the sum of the two dice is 6?

9. Solve the equations:

   a) $\log\left(\frac{x^3}{4}\right) = \log \ 5x^2$

   b) $\log_2^{\,3} \ x^2 = \log_2^{\,2} \ x$

   Note: $\log^2 \ A$ is shorthand for $\log(A)^{\,2}$

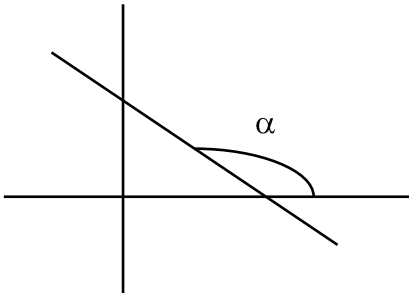
10. Find the inverse of each of the following:

a) $f(x) = 3\log_5 x$ b) $g(x) = 4^{3x-2}$

11. The day Jennifer was born her rich uncle set up a trust for her and invested $12,000 at 6.8 % interested compounded monthly. At the end of what year and month will the investment be worth $60,000?

12. Find the angle of inclination , α, that the line makes with the positive x-axis. (To the nearest tenth of a degree.)

$$10x + 3y = 8$$



13 If $\log_x 5 = \text{p}$, $\log_x 2 = \text{q}$, and $\log_x 3 = \text{r}$. Determine each of the following in terms of **p**, **q** and **r**. (No approximations)

a) $\log_x(60)$ b) $\log_x\left(\frac{16}{27}\right)$ c) $\log_x(0.5)$ d) $\frac{\log_x(25)}{\log_x(9)}$

14. A wheel rotates counterclockwise at a constant of once every 12 seconds. Imagine the center of the wheel is the origin and its radius is 1. A point P is marked on the wheel, and at time $t = 0\text{sec}$ it has coordinates (1, 0).

a) How far does P travel in 1 minute? (State exactly)

b) If we imagine an angle formed by the positive x-axis and a line from the origin through P, how many degrees does the point rotate in 1 minute? Give your answer to one decimal place.

c) At 2 seconds, what are the coordinates of P?

15. Write as a single logarithm: $2\log_b 5x^3 - \frac{1}{2}\log_b(2x+3)$.

16. The logistic growth model is used to model population growth (among other things) and has a general formula of

$$P(t) = \frac{c}{1 + ae^{-bt}}$$

where *a*, *b*, and *c* are constants, *t* is time. If $b > 0$ the model is growth and if $b < 0$ the model is of decay. This problem is going to have you explore some properties of this model.

Suppose you are studying the fruit fly population in a closed container. The population for the number of fruit flies after *t* days is given by

$$P(t) = \frac{230}{1 + 56.5e^{-0.37t}}$$

a) Use your computer to graph this function and attach your graph to your answer sheets. Set your window to x: -10 to 40, y: -10 to 250

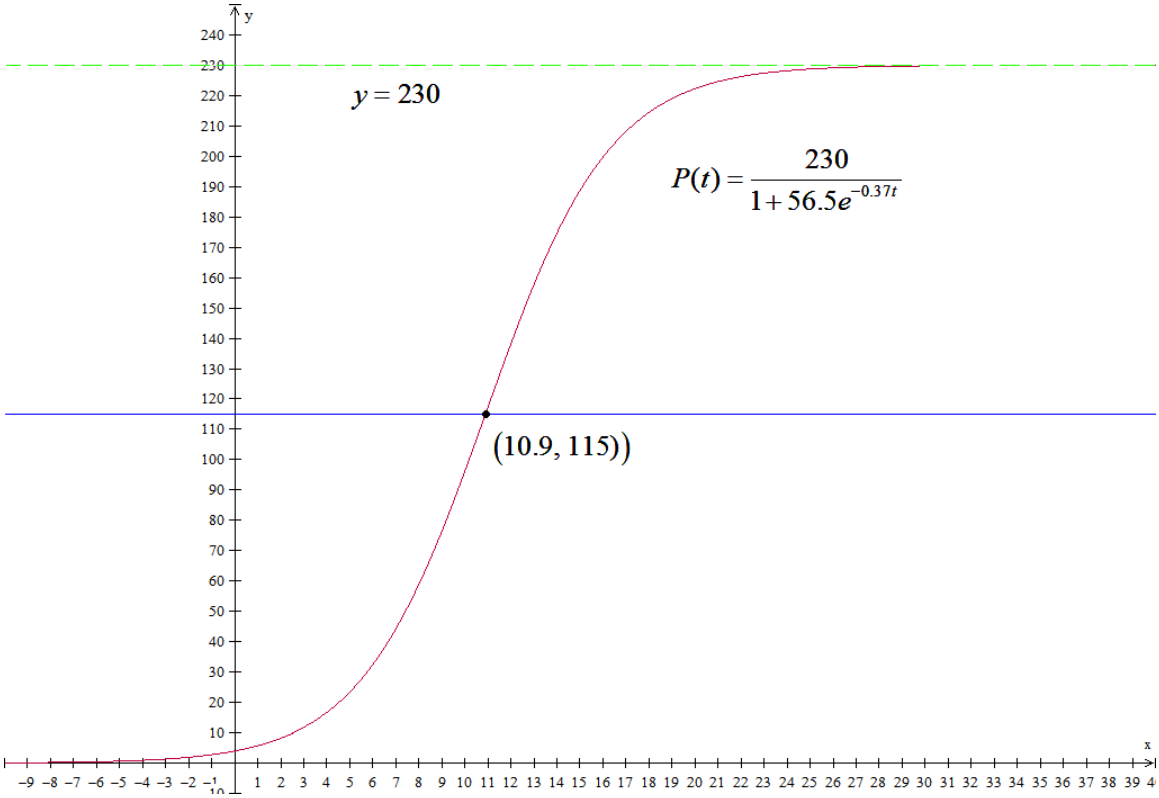
b) What was the initial population?

c) As time goes by the population 'levels' off to what is called the carrying capacity. What appears to be the carrying capacity in this situation? In calculus we call this a limit.

d) How long does it take the population to reach 180? (Use algebra to solve this question.)

e) There is a point on the graph where the curve where the population is increasing at the greatest rate. This point is called an *inflection point* of the graph. In this case it occurs at one half the carrying capacity. Use graphing technology to find this point. Show this point on the graph you attach.

f) Find a student that has completed the first semester of calculus and ask him/her what the meaning is of inflection point. Write the explanation on your problem set, giving the name of the student with whom you spoke.


y
x
$y = 230$
$P(t) = \frac{230}{1 + 56.5e^{-0.37t}}$
(10.9, 115))