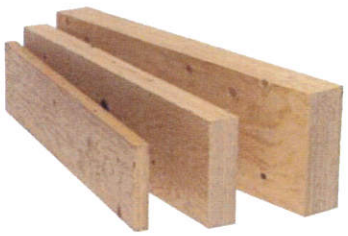
Mth 96 Final Exam Review

- Justify and show the means by which you arrive at your answers for full credit.
- Place a **box** around your final answer.
- Answers must be labeled for full credit.

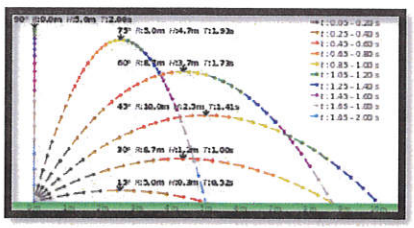
1. Consider the weight of a truck modeled by the function: $W = 520B + 28{,}450$; Where **W** is the net weight of the truck in pounds and **B** is the number of beams it is hauling.



   a. Find the slope and explain its meaning in context in a complete sentence.
   on separate sheet
   b. Find the y-intercept and explain its meaning in context in a complete sentence.
   on separate sheet
   c. Find the truck's weight if it is hauling 62 beams.
   on separate sheet
   d. Find the number of beams that can be loaded to stay under a 70,000 pound weight limit.
   on separate sheet

2. Consider the path of a bullet modeled by the function: $h = -5.9t^2 + 266t + 7$; Where **t** is the time in seconds and **h** is the height in feet.

   a. Find the maximum height the bullet reaches using the vertex formula ($x = \frac{-b}{2a}$).
   on separate sheet
   b. Find the y-intercept and explain its meaning in context.
   on separate sheet
   c. Find the slope between 3 and 4 seconds.
   on separate sheet
   d. Calculate the x-intercept and explain its meaning in context.
   on separate sheet
   e. Find the height at 32 seconds.
   on separate sheet
   f. Find the times it is at 2000 feet.
   on separate sheet



3. Consider the number of people who have a land line phone modeled by the function: $p = 86200 * 0.84^t$; Where **t** is the time in years and **p** is the number of people in a town with a land line.

   a. Find the number of people that you would expect to still have a land line in 12 years.
   on separate sheet
   b. Find the time it will take for there to be 25,000 people with a land line.
   on separate sheet
   c. State the growth rate and explain it meaning in context in a complete sentence.
   on separate sheet
   d. Find the y-intercept and explain its meaning in context.
   on separate sheet
   e. Find the slope between years 6 and 7.
   on separate sheet

4. Consider the flow of water through a pipe modeled by the function: $f = 16d^{0.473}$; Where **d** is the diameter of the pipe in inches and **f** is the flow in gallons per minute (GPM).

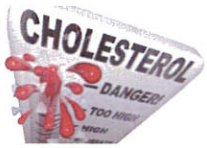
   a. Find the flow for a 4 inch diameter pipe.
   On separate sheet
   b. Find the diameter of pipe necessary to carry 40 GPM.
   On separate sheet
   c. Find the slope between the 2 and 3 inch diameters.
   On separate sheet

5. Consider the number of dogs who have been vaccinated modeled by the function: $d = 54 + 26.8\ln t$; Where **t** is the time in days and **d** is the number of dogs.

   a. Find the number of dogs you would expect to be vaccinated by day 7.
   On separate sheet
   b. Find the time it will take for 150 dogs to be vaccinated.
   On separate sheet
   c. Find the slope between the days 4 and 5.
   On separate sheet

6. The chart shows the effect of different dosages of Lipitor on a patient's cholesterol.

Dosage (mg)	Cholesterol (mg/dL)
5	346
10	294
15	250
20	222
25	198
30	178
35	162
40	150



   a. Use regression to find the best model for the data.
   On separate sheet
   b. Why did you choose your model?
   On separate sheet
   c. Find the cholesterol level you would expect if the patient takes 50 mg of Lipitor.
   On separate sheet
   d. Find the dosage that would be required to get the cholesterol level down to 110 mg/dL.
   On separate sheet

7. The chart shows the effect of wind speed on a road sign.

Wind Speed (MPH)	Force (pounds)
10	42
20	89
25	122
35	182
45	256
60	384

   a. Use regression to find the best model for the data.
   On separate sheet
   b. Why did you choose your model?
   On separate sheet
   c. Find the force for a 40 MPH wind.
   On separate sheet
   d. Find the wind speed required to produce 300 pounds of force on the sign.
   On separate sheet

Review

1.) $W = 520B + 28,450$

a.) $m = 520$

weight per beam

Each beam the truck carries weighs 520lbs.

b.) $y = 28,450$

Starting weight of the truck

The weight of truck is about 28,450lbs without any beams.

c.) Find w when $b = 62$

$w = 520(62) + 28,450$

$w = 32,240 + 28,450$

$w = 60,690$lbs

with 62 beams the truck weighs about 60,690lbs.

d.) Find B when $W = 70,000$

$70000 = 520B + 28,450$

$-28,45 \qquad -28,450$

$$\frac{41,550}{520} = \frac{520B}{520}$$

$79,90384615 = B$ $\quad B \approx 80$ beams

The truck can carry about 80 beams and meet the 70,000lbs weight limit.

2. a.) $X = \frac{-b}{2a}$ $\quad h = -5.9t^2 + 266t + 7$

$X = \frac{-266}{2(-5.9)} = \frac{-266}{-11.8} = 22.542372 88$

(x, y)

$h = -5.9(22.542372 88)^2 + 266(22.542372 88) + 7$

$h = 3005.135593 ft$

$(22.54, 3005.14)$

The max height the bullet reaches is about 3005 ft

b.) $y = c \quad y = 7$

The bullet started at 7ft high.

c.) 3 seconds $= t$

$h = -5.9(3)^2 + 266(3) + 7$ $\quad (3, 751.9)$

$h \approx 751.9$

4 second $= t$ $\quad (4, 976.6)$

$h = -5.9(4)^2 + 266(4) + 7$

$h \approx 976.6$

$m = \frac{751.9 - 976.6}{3 - 4} = \frac{-224.7}{-1} \approx 224.7$

Between 3 and 4 seconds the bullet is traveling 224.7 ft/sec

2. d) Find t when $h = 0$

$$-5.9t^2 + 266t + 7 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-266 \pm \sqrt{266^2 - 4 \cdot (-5.9) \cdot 7}}{2 \cdot (-5.9)}$$

$$x = \frac{-266 \pm \sqrt{70,921.2}}{-11.8}$$

$$x = \frac{-266 \pm 266.3103453}{-11.8}$$

$$x = \frac{-266 + 266.3103453}{-11.8} \qquad x = \frac{-266 - 266.3103453}{-11.8}$$

$x = -0.026300447$

Can't have negative time

$x = 45.11104621$

It takes about 45 seconds for the bullet to hit the ground.

e.) Find h when $t = 32$

$-5.9(32)^2 + 266(32) + 7$

$h \approx 2477.4$

After 32 seconds the height is about 2477 ft

f.) Find t when $h = 2000$

$$-5.9t^2 + 266t + 7 = 2000$$
$$-2000 \quad -2000$$

$$-5.9t^2 + 266t - 1993 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-266 \pm \sqrt{266^2 - 4(-5.9)\cdot(-1993)}}{2(-5.9)}$$

$$x = \frac{-266 \pm \sqrt{23721.2}}{-11.8}$$

$$x = \frac{-266 \pm 154.01688822}{-11.8}$$

$$x = \frac{-266 + 154.01688822}{-11.8} \qquad x = \frac{-266 - 154.01688822}{-11.8}$$

$$x \approx 9.49009473 \qquad x = 35.59465103$$

When the height is 2000ft the times is 9.5 seconds on the way up and 35.6 seconds on the way down.

3.) a.) Find p when $t = 12$

$p = 86200 \cdot 0.84^{12}$

$p = 10,637.96846$

$p \approx 10638$

The number of people with a land line in 12 years will be about 10,638.

b.) Find t when $p = 25,000$

$$\frac{25,000}{86200} = \frac{86200 \cdot 0.84^t}{86200}$$

$$\log 0.2900232019 = \log 0.84^t$$

$$\frac{\log 0.2900232019}{\log 0.84} = \frac{t \cdot \log 0.84}{\log 0.84}$$

$t \approx 7.099342164$

$t \approx 7.1$ years

In about 7.1 years, 25,000 will have a landline.

c.) growth rate = 0.84

$1 - 0.84 = .16$

16%

This means landlines are decreasing at a rate of 16%

3. d) Find p when $t = 0$

$p = 86200 \cdot 0.84^0$

$p = 86200 \cdot 1$

$p = 86200$

There are about 86200 people with a landline at year zero.

e.) Find p when $t = 6$

$p = 86200 \cdot 0.84^6$

$p = 30,281.89033$

(6, 30,281.89)

Find p when $t = 7$

$p = 86200 \cdot 0.84^7$

$p = 25436.78787$

(7, 25436.79)

$$m = \frac{30,281.89 - 25436.79}{6 - 7} = \frac{4845.1}{-1}$$

$m \approx -4845.1$

Between year 6 and 7 the number of people with a landline dropped by about 4845 people

4.) a.) Find f when $d = 4$

$f = 16 \cdot 4^{0.473}$

$f = 30.82438061$

$f \approx 31$ Gpm

A pipe with a 4 in diameter has a flow rate of about 31 gpm

b.) Find d when $f = 40$

$\frac{40}{16} = \frac{16 \cdot d^{0.473}}{16}$

$(2.5)^{\frac{1}{0.473}} = (d^{0.473})^{\frac{1}{0.473}}$

$d = 6.939222302$

$d \approx 7$ in

A pipe with a 7 in diameter has a flow rate of 40 gpm

c.) Find f when $d = 2$ (2, 22.21)

$f = 16 \cdot 2^{0.473}$ $f = 22.20788835$

Find f when $d = 3$ (3, 26.90)

$f = 16 \cdot 3^{0.473}$ $f = 26.90285285$

$m = \frac{22.21 - 26.90}{2 - 3} = \frac{-4.69}{-1} = 4.69$

Between 2 and 3 inch diameter pipe the flow rate increases by 4.7 gpm

5.) a.) Find d when $t=7$

$d = 54 + 26.8 \ln 7$

$d = 106.150392$

The number of dogs you would expect to be vaccinated by day 7 is about 106.

b.) Find t when $d=150$

$150 = 54 + 26.8 \ln x$

$-54 \quad -54$

$\frac{96}{26.8} = \frac{26.8 \ln x}{26.8}$

$e^{3.582089552} = e^{\ln x}$

$x = 35.94857886$

After about 36 day 150 dogs will be vaccinated

c.) Find d when $x=4$ $(4, 91.15)$

$d = 54 + 26.8 \ln 4$

$d = 91.15268888$

Find d when $x=5$ $(5, 97.13)$

$d = 54 + 26.8 \ln(5)$

$d = 97.13293605$

$m = \frac{97.13 - 91.15}{5 - 4} = \frac{5.98}{1} = 5.98$

Between 4 and 5 days the number of dogs being vaccinated increases by about 5.98 dogs per day

6.) Best fit would be logarithmic

a.) Find the logarithmic equation using regression
Round to 2 decimal places

$y = a + b \ln x$

$a = 508.9670502$

$b = -96.75153861$

$y = 508.97 - 96.75 \ln x$

b.) Skip not on test

c.) Find y when $x = 50$

$y = 508.97 - 96.75 \ln 50$

$y \approx 130.4817742$

Cholesteral level should be about 130.5 mg/dL with 50 mg of Lipitor.

d.) Find x when $y = 110$

$110 = 508.97 - 96.75 \ln x$

$-508.97 \quad -508.97$

$\frac{-398.97}{-96.75} = \frac{-96.75 \ln x}{-96.75}$

$e^{4.123720093} = e^{\ln x}$

$x = 61.78872659$

$x \approx 62$ mg

The dosage should be about 62 mg to get Cholesterol down to 110 mg/dL

7.) Best fit would be quadratic

a.) Find the quadratic equation using regression
Round to 4 decimal places

$y = ax^2 + bx + c$

$a = 0.047913628 5$

$b = 3.48792092$

$c = 2.124038844$

$y = 0.0479x^2 + 3.4879x + 2.1240$

b.) Skip not on test

C.) Find y when $x = 40$

$y = 0.0479(40)^2 + 3.4879(40) + 2.1240$

$y \approx 218.28$

The force for a wind speed of 40 mph would be about 218.3 lbs

d.) Find x when $y = 300$ lbs

$300 = 0.0479x^2 + 3.4879x + 2.1240$

$-300 \qquad\qquad -300$

$0.0479x^2 + 3.4879x - 297.876 = 0$

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

7 d.)

$$X = \frac{-3.4879 \pm \sqrt{(3.4879)^2 - 4(0.0479)(-297.876)}}{2(0.0479)}$$

$$X = \frac{-3.4879 \pm \sqrt{69.23848801}}{0.0958}$$

$$X = \frac{-3.4879 \pm 8.320966771}{0.0958}$$

$$X = \frac{-3.4879 + 8.320966771}{0.0958} \quad \text{or} \quad X = \frac{-3.4879 - 8.320966771}{0.0958}$$

$X = 50.44954876$

$X \approx 50.45 \text{ mph}$

$x = -123.2658327$

Can't have negative speed

It will take a wind speed of about 50.45mph to create a force of 300lbs