

## EXAM 4 - MATH 111

YOUR NAME: \_\_\_\_\_

Friday, December 2

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Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

- Under certain conditions tsunami waves that encounter land will develop into what are called *bore*s. The velocity  $V$  of the tip of a bore is proportional to the square root of its height  $h$ , with constant of proportionality  $k$ :

$$V = k \cdot h^{0.5}.$$

- (a) How does the velocity of the tip compare with its initial velocity, when the height of the bore is reduced to half its initial height?
  
  - (b) How does the height of the bore compare to its initial height when the velocity of its tip is reduced to half of its initial velocity?
  
  - (c) If the tip of one bore is three times the height of another, how do their velocities compare?

2. The following table shows the diameter  $d$  and the height  $h$  (both in feet) of some types of trees:

Type	Cottonwood	Hackberry	Weeping Willow	Ponderosa Pine	Douglas fir
Diameter $d$	2.9	5.7	6.2	8.6	14.4
Height $h$	80	113	95	162	221

(a) Make a plot of  $\ln h$  versus  $\ln d$ .

(b) Find a formula for the regression line of  $\ln h$  vs.  $\ln d$ .

(c) Find a formula that models  $h$  as a power function of  $d$ .

3. The following table gives the height  $h$  in inches and the weight  $w$  in pounds of an average adult male.

$h$	61	62	66	68	70	72	74	75
$w$	131	133	143	149	155	162	170	175

- (a) Make a power model for weight versus height.
- (b) If the height is increased by 10%, what percentage increase in weight can be expected according to your model?
- (c) If the weight is increased by 20%, by which percentage is the height expected to increase?

4. A Thanksgiving turkey is sitting at a baking tray in a room with temperature  $65^\circ$  Fahrenheit. It is placed into a preheated oven at  $325^\circ$ . The difference  $D(t)$  of the limiting value of the temperature of the turkey minus its temperature  $T(t)$  at time  $t$  hours after being placed in the oven is an exponential function of  $t$ .

(a) What is  $D(0)$ ?

(b) After 4 hours the turkey has reached a temperature of  $265^\circ$  F. Use this information to find a formula for the difference  $D$  versus time  $t$ .

(c) Find a formula for the temperature of the turkey  $T$  in terms of time  $t$ .

(d) If the turkey is safe to serve when its temperature has reached  $300^\circ$ F, after how many hours is it supposed to be served?