

MATH 140. TEST 4 B (FALL 2004. HARVEY).

Name (3 points): \_\_\_\_\_

No notes or texts allowed. You may use a TI-83, TI-84, TI-86 or equivalent calculator. Show all work. Each problem is worth 10 points.

1. (5 points) What is the domain of the function  $f(x) = \log_3(x - 5)$ ? What is the equation of the asymptote?

2. (7 points) Write an equivalent expression that does not contain any products, quotients, powers, or roots:

$$\log\left(\frac{(x+1)^3\sqrt{x-4}}{x^2}\right)$$

3. (7 points) Write an equivalent expression with only one logarithm:

$$\log(x-2) + 3\log(x-4) - \frac{1}{5}\log(x+1)$$

**4-6 (7 points each).** In problems 4-6, solve for  $x$ . Give your answer to two decimal places.

4.

$$e^{x-4} = 21$$

5.

$$\log_3(x - 4) + \log_3(x - 2) = 1$$

6.

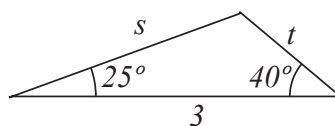
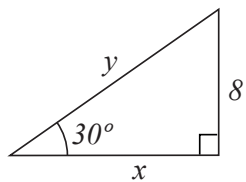
$$e^{2x} + e^x - 12 = 0$$

7. **(10 points)** According to United Nations estimates, the world population was approximately 2 billion in 1930 and approximately 4 billion in 1974. Assuming an exponential model to approximate this population growth, what is the annual growth rate?

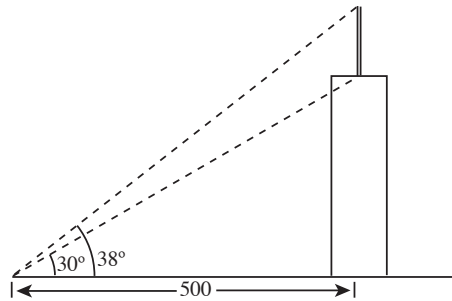
8. **(10 points)** In 1991 hikers discovered the mummified remains of a man in the Alps in Northern Italy. Samples tested indicated that 53% of the original Carbon-14 remained. Based on this, approximately how long ago did the Iceman die (recall that the half-life of Carbon-14 is 5730 years)?

9. (10 points) Convert the angle measure  $37^{\circ}33'25''$  to decimal degrees.

10. (12 points) Find  $x$ ,  $y$ ,  $s$ , and  $t$ :



11. (10 points) A radio antenna sits atop a tall building. When viewed from a distance of 500 ft, the angle of elevation to the base of the antenna is  $30^\circ$  and the angle of elevation to the top of the antenna is  $38^\circ$ . How tall is the radio antenna?



12. (10 points) A 100 foot tower is built on a hill with a  $15^\circ$  slope. We wish to add two stabilizing wires from the top of the tower to the ground as illustrated below. How long will the two wires need to be?

