

## Final Exam

2017-11-21 suggestion: use diagram riceknight491a.png. The points  $A$  and  $B$  in the figure are on opposite sides of the river and inaccessible from points  $x$  and  $y$ . Find the distance  $AB$  from the survey notes:  $xy=450$  ft, angle  $Ayx=32^\circ$ ,  $Axy=129^\circ$ ,  $Bxy=43^\circ$ , and  $Byx=113^\circ$ .

Show all of your work. Correct answers without showing how to get them does not earn you points.

**There are TWO pages and NINE questions.** The maximum number of points is 100.

(1) Solve the logarithmic equation. Do not use a calculator for your calculation. It's OK to use a calculator to check your answer. [10]

$$\log_2 x - \log_2 \frac{1}{4} = 3 \quad (1)$$

(2) Solve the trigonometric equation. [12]

$$2 - \cos \vartheta = 2 \sin^2 \vartheta + 1 \quad (2)$$

(3) Solve the following system of equations by any method.[10]

$$\begin{array}{rcl} x & + & \frac{1}{5}y = \frac{4}{3} \\ 3x & - & 2y = -9 \end{array} \quad (3)$$

(4) Solve the following triangle in the plane. Clearly indicate the three missing items and their solutions. [12]

$$a = 234, b = 461, c = 307 \quad (4)$$

(5) The time it takes to ride your bicycle from home to work is normally distributed with a mean of 28.4 minutes and a standard deviation of 3.1 minutes. What is the probability that the bike ride takes more than half an hour? [10]

(6) Solve the following spherical triangle. Clearly indicate the three missing items and their solution. Hint:  $c$  is greater than  $90^\circ$  (use the alternative solution when you take the inverse sine function of  $\sin c$ ). [12]

$$A = 24^\circ 53' 39'', b = 32^\circ 5' 34'', C = 93^\circ 40' 45'' \quad (5)$$

(7) Solve the exponential equation. Do not use a calculator for your calculation. It's OK to use a calculator to check your answer. [10]

$$3^{x-1} = e^{3x} \quad (6)$$

(8) Solve the following right spherical triangle with a right angle at  $A$ . [12]

$$b = 56^\circ 21' 30'', B = 59^\circ 15' 32'' \quad (7)$$

(9) According to 2010 census data, the ratio of men to women among centenarians is 1 : 4 (i.e. 20% of centenarians are men). What is the probability that out of 50 centenarians 12 or more are male? [12]