

# Minitest 1A MTH 1310

Dr. Graham-Squire, Fall 2012

Name: \_\_\_\_\_

*Key*

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I pledge that I have neither given nor received any unauthorized assistance on this exam.

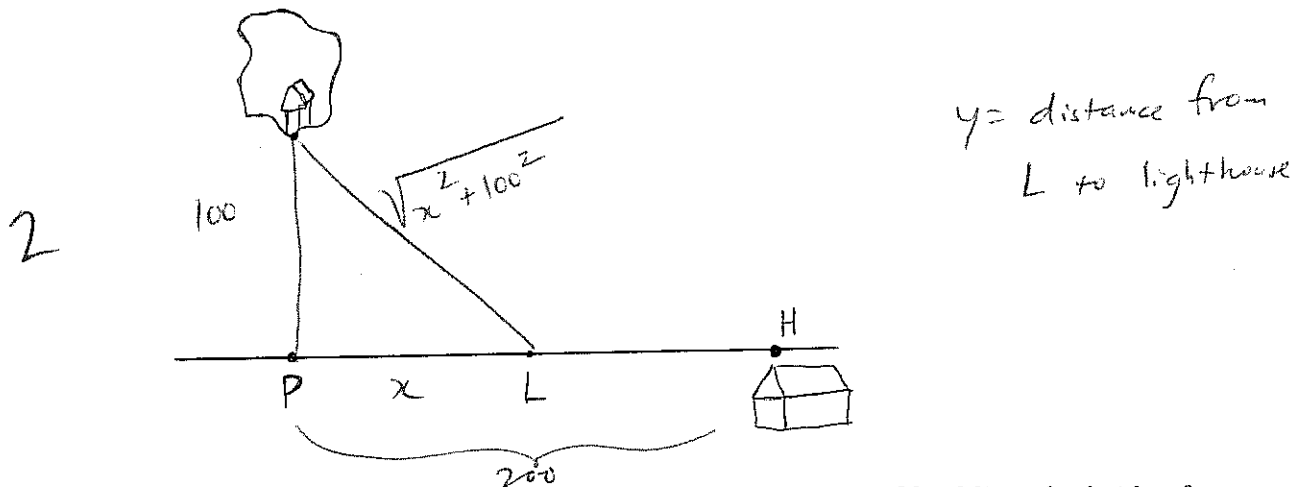
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## DIRECTIONS

1. Show all of your work and use correct notation. A correct answer with insufficient work or incorrect notation will lose points.
2. Clearly indicate your answer by putting a box around it.
3. Cell phones and computers are not allowed on this test. Calculators are allowed on all parts of the test, however you should still show all of your work.
4. Give all answers in exact form, not decimal form (that is, put  $\pi$  instead of 3.1415,  $\sqrt{2}$  instead of 1.414, etc) unless otherwise stated.
5. If you need to use the quadratic formula, it is  $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ .
6. Make sure you sign the pledge.
7. Number of questions = 5. Total Points = 45.

1. (10 points) A lighthouse is on an island 100 feet from a straight coastline. The point  $P$  is the point on the coast closest to the lighthouse, and 200 feet down the coast from  $P$  is a house full of lemurs,  $H$ . The lemurs want to build a wooden bridge to the lighthouse, but they can't decide if they want to have it go straight diagonally from their house to the island, or just straight from the point  $P$ , or something in between. Let  $L$  be the point on the coast between  $P$  and  $H$  where the lemurs build the bridge to connect to the island, and  $x$  the distance from  $P$  to  $L$ . The bridge costs \$4 per linear foot to build.

Diagram:



- (a) Write an equation, in terms of  $x$ , representing the cost of building the bridge from  $L$  to the lighthouse.
- (b) If the lemurs have \$1000, can they build the bridge directly from their house to the lighthouse?

(a)  $y^2 = x^2 + 100^2$

$\Rightarrow y = \sqrt{x^2 + 100^2}$

Cost =  $C(x) = 4\sqrt{x^2 + 100^2}$

(b) If  $x = 200$ ,  $C(200) = 4\sqrt{200^2 + 100^2} = 4\sqrt{50,000} \approx \$894$  to

build bridge.

So yes, they have enough money to

build the bridge

4

✓

2. (12 points) The average daily hotel rate in High Point, from 2006 through 2011, is approximated by the function

$$f(t) = \begin{cases} 70 + 5t & \text{if } 0 \leq t < 3 \\ 110 - 10t & \text{if } 3 \leq t \leq 6 \end{cases}$$

where  $f(t)$  is measured in dollars with  $t = 0$  corresponding to 2006.

- (a) What was the average daily hotel rate in 2006?

$$t = 0 \Rightarrow 70 + 5 \cdot 0 = \boxed{\$70}$$

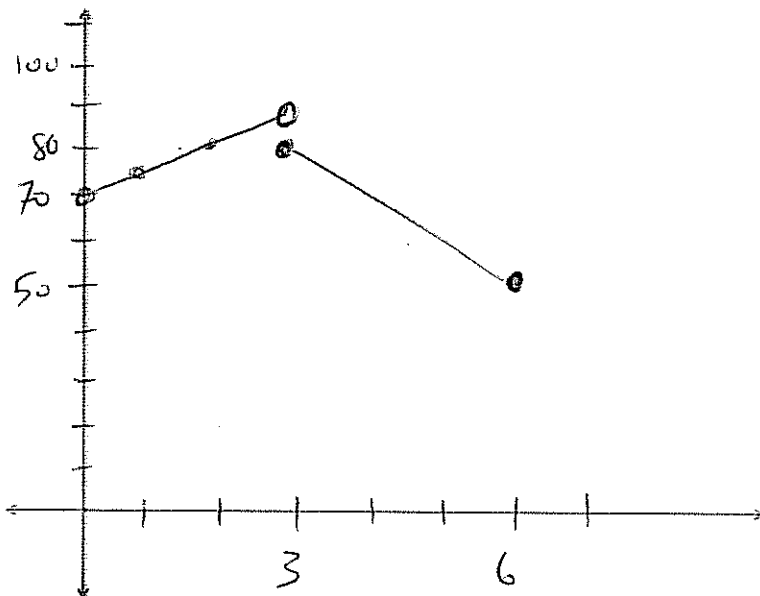
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- (b) What was the average daily hotel rate in 2009?

$$t = 3 \Rightarrow 110 - 10(3) = \$80$$

2

- (c) Sketch a graph of  $f$ :



3. (5 points) Determine if the line through the points (5, 1) and (3, 6) is parallel to the line through the points (1, -2) and (-6, 1). Explain your reasoning. Graphing the lines may help, but you do not need to graph them to get a correct answer.

$$\text{Line 1: } \frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - 1}{3 - 5} = \frac{5}{-2} \quad \text{is slope}$$

$$\text{Line 2: } \frac{1 - (-2)}{-6 - 1} = \frac{3}{-7} \quad \text{is slope.}$$

Slopes are not equal, so the

lines are not parallel.

5. (8 points) Let  $f(x) = 3x^2 + 2x + 1$  and  $g(x) = x + 3$ . Find and simplify

(a)  $f(g(x))$

(b)  $g(f(-2))$

$$(a) f(g(x)) = f(x+3) = 3(x+3)^2 + 2(x+3) + 1 \quad \checkmark\checkmark\checkmark$$

$$= 3(x^2 + 6x + 9) + 2x + 6 + 1$$

$$= 3x^2 + 18x + 27 + 2x + 7$$

$$= \boxed{3x^2 + 20x + 34}$$

- | if no  
= sign

5

$$(b) f(-2) = 3(-2)^2 + 2(-2) + 1 = 12 - 4 + 1 = 9$$

$$g(f(-2)) = g(9) = 9 + 3 = \boxed{12}$$

3

Extra Credit (2 points) Let  $h(x) = \begin{cases} 4+x & \text{if } 0 \leq x < 5 \\ 2x-6 & \text{if } 5 \leq x \leq 8 \end{cases}$ . Is  $h$  a function? Explain why or why not.

No, b/c  $x=5$  has two  $y$ -values,

$$\text{both } 4+5 = 9$$

$$\text{and } 2(5)-6 = 4$$

4. (10 points) (a) Simplify the expression by combining the fractions and writing the resulting fraction in simplest terms.

No calculator!

$$\frac{5}{x-2} - \frac{2x+16}{x^2-4}$$

if we  
= signs. ✓

$$= \frac{5(x+2)}{(x-2)(x+2)} - \frac{2(x+16)}{(x+2)(x-2)}$$

$$= \frac{5x+10 - (2x+16)}{(x-2)(x+2)}$$

$$= \frac{3x-6}{(x+2)(x-2)}$$

$$= \frac{3(x-2)}{(x+2)(x-2)}$$

$$= \boxed{\frac{3}{x+2}}$$

6

(b) Simplify  $\frac{4^{5.1} \cdot 4^{-0.8}}{4^{2.3}}$ .

$$= \frac{4^{5.1-0.8}}{4^{2.3}}$$

$$= \frac{4^{4.3}}{4^{2.3}}$$

$$= 4$$

$$= 4^{4.3-2.3}$$

$$= 4^2$$

$$= \boxed{16}$$

4

# Minitest 1B- MTH 1310

Dr. Graham-Squire, Fall 2012

Name: Key

I pledge that I have neither given nor received any unauthorized assistance on this exam.

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(signature)

## DIRECTIONS

1. Show all of your work and use correct notation. A correct answer with insufficient work or incorrect notation will lose points.
2. Clearly indicate your answer by putting a box around it.
3. Cell phones and computers are not allowed on this test. Calculators are allowed on the first four questions of the test, however you should still show all of your work. No calculators are allowed on the last question.
4. Give all answers in exact form, not decimal form (that is, put  $\pi$  instead of 3.1415,  $\sqrt{2}$  instead of 1.414, etc) unless otherwise stated.
5. If you need to use the quadratic formula, it is  $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ .
6. Make sure you sign the pledge.
7. Number of questions = 5. Total Points = 45.

1. (5 points) Determine if the line through the points (6, 1) and (4, 6) is parallel to the line through the points (-2, -4) and (-4, 1). Explain your reasoning. Graphing the lines may help, but you do not need to graph them to get a correct answer.

$$\text{Slope of } L_1 = \frac{6-1}{4-6} = \frac{5}{-2}$$

$$\text{Slope of } L_2 = \frac{1-(-4)}{-4-(-2)} = \frac{5}{-2}$$

The slopes are equal so the

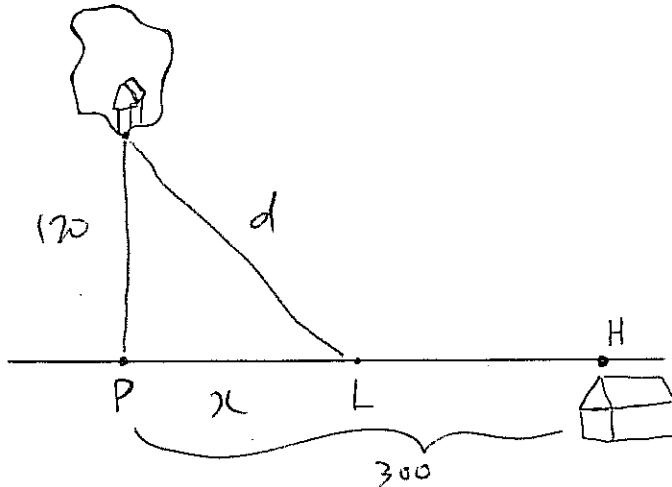
lines are parallel

(Note that they are also not the same line.)



2. (10 points) A lighthouse is on an island 120 feet from a straight coastline. The point  $P$  is the point on the coast closest to the lighthouse, and 300 feet down the coast from  $P$  is a house full of lemurs,  $H$ . The lemurs want to build a wooden bridge to the lighthouse, but they can't decide if they want to have it go straight diagonally from their house to the island, or just straight from the point  $P$ , or something in between. Let  $L$  be the point on the coast between  $P$  and  $H$  where the lemurs build the bridge to connect to the island, and  $x$  the distance from  $P$  to  $L$ . The bridge costs \$6 per linear foot to build.

Diagram:



2

- (a) Write an equation, in terms of  $x$ , representing the cost of building the bridge from  $L$  to the lighthouse.  
 (b) If the lemurs have \$1000, can they build the bridge directly from their house to the lighthouse?

(a)  $d^2 = x^2 + 120^2 \Rightarrow d = \sqrt{x^2 + 14400}$  \$6 per foot 4

(b)  $d(300) = \sqrt{300^2 + 14400} = 323.1$   $C(x) = 6\sqrt{x^2 + 14400}$

$\Rightarrow C(300) = 6(323.1) = 1938.6$

~~So it would~~  
 So the lemurs do not have enough money. 4

3. (12 points) The average daily hotel rate in High Point, from 2006 through 2011, is approximated by the function

$$f(t) = \begin{cases} 80 - 5t & \text{if } 0 \leq t < 3 \\ 40 + 10t & \text{if } 3 \leq t \leq 6 \end{cases}$$

where  $f(t)$  is measured in dollars with  $t = 0$  corresponding to 2006.

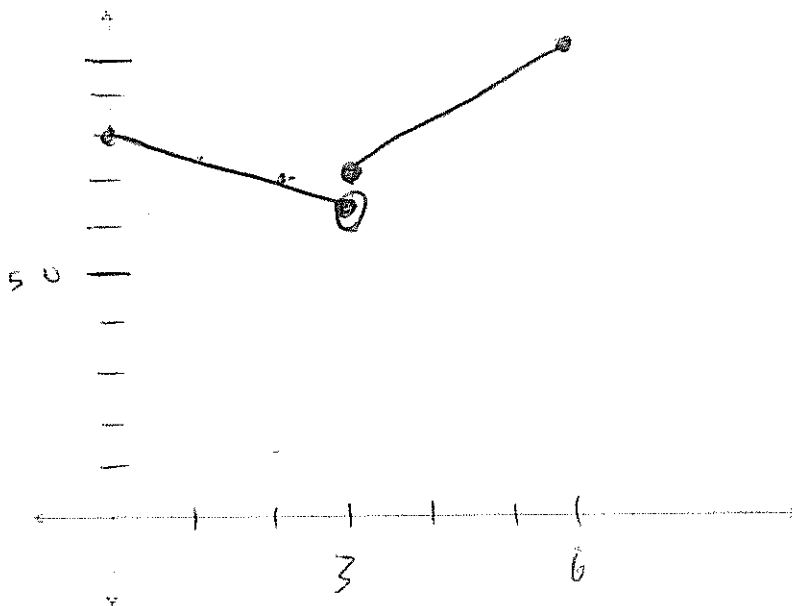
- (a) What was the average daily hotel rate in 2006?

$t = 0$        $f(0) = 80 - 5(0) = \boxed{\$80}$

- (b) What was the average daily hotel rate in 2009?

$t = 3$        $f(3) = 40 + 10(3) = \boxed{\$70}$

- (c) Sketch a graph of  $f$ :



4. (8 points) Let  $f(x) = 2x^2 + 3x + 4$  and  $g(x) = x + 1$ . Find the following and simplify your answer if possible.

(a)  $f(g(x))$

(b)  $g(f(-2))$

$$(a) f(x+1) = 2(x+1)^2 + 3(x+1) + 4 \quad \checkmark \checkmark$$

$$= 2(x^2 + 2x + 1) + 3x + 3 + 4 \quad \checkmark$$

$$= 2x^2 + 4x + 2 + 3x + 7$$

$$\boxed{= 2x^2 + 7x + 9} \quad \checkmark$$

-1 if  
no = signs.

$$(b) f(-2) = 2(-2)^2 + 3(-2) + 4 = 8 - 6 + 4 = 6 \quad \checkmark \checkmark$$

$$g(f(-2)) = g(6) = 6 + 1 = \boxed{7} \quad \checkmark$$

Extra Credit(1 point) Let  $h(x) = \begin{cases} 3+x & \text{if } 0 \leq x \leq 5 \\ 2x-4 & \text{if } 5 \leq x \leq 8 \end{cases}$ . Is  $h$  a function? Explain why or why not.

No b/c  $x=5$  has two different  
outputs, 8 and 6



Name: \_\_\_\_\_

Key

5. (10 points) (a) Simplify  $\frac{5^{-1.6} \cdot 5^{3.9}}{5^{0.3}}$ .

$$= \frac{5^{2.3}}{5^{0.3}}$$

$$= 5^2$$

$$= \boxed{25}$$

$$\begin{array}{r} 3.9 \\ -1.6 \\ \hline 2.3 \end{array}$$

(b) Simplify the expression by combining the fractions and writing the resulting fraction in simplest terms.

$$\frac{4}{x+3} - \frac{2(x+15)}{x^2-9}$$

$$= \frac{4(x-3)}{(x+3)(x-3)} - \frac{2x+30}{(x+3)(x-3)}$$

$$= \frac{4x-12 - (2x+30)}{(x+3)(x-3)}$$

$$= \frac{4x-2x-12-30}{(x+3)(x-3)} = \frac{2x-42}{(x+3)(x-3)}$$

$$= \boxed{\frac{2(x-21)}{(x+3)(x-3)}}$$

