

^{and D}
Minitest 1A - MTH 1210

Dr. Graham-Squire, Fall 2013

Name: Key

$\frac{8:36}{8:45}$
 $\frac{\quad}{9} \Rightarrow 36 \text{ minutes?}$

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

(signature)

DIRECTIONS

1. Don't panic.
2. Show all of your work and use correct notation! A correct answer with insufficient work or incorrect notation will lose points.
3. Clearly indicate your answer by putting a box around it.
4. Cell phones and computers are not allowed on this test. Calculators are allowed on the first 2 questions of the test, however you should still show all of your work. No calculators are allowed on the last 2 questions.
5. Give all answers in exact form, not decimal form (that is, put π instead of 3.1415, $\sqrt{2}$ instead of 1.414, etc) unless otherwise stated.
6. Make sure you sign the pledge.
7. Number of questions = 4. Total Points = 40.

types:

(x, y) - coordinate (Answer 4)

and
Question (2) (E. (red))

1. (10 points) Find the average rate of change for the function $f(x) = 3x^2 - 2x$ from $x = 2$ to $x = 2 + h$.

$$f(2+h) = 3(2+h)^2 - 2(2+h) = 3(4+4h+h^2) - (4+2h)$$

$$= 12 + 12h + 3h^2 - 4 - 2h$$

$$= 8 + 10h + 3h^2$$

$$f(2) = 3(2^2) - 2(2) = 12 - 4 = 8$$

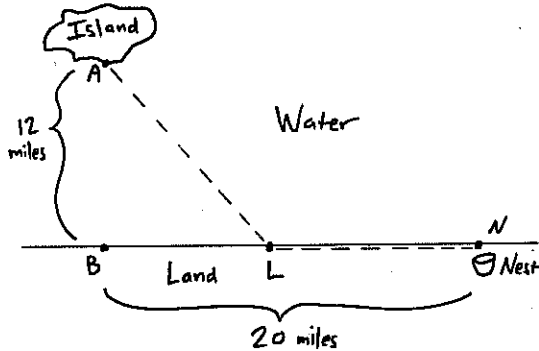
$$\frac{f(2+h) - f(2)}{2+h-2} = \frac{8 + 10h + 3h^2 - 8}{h}$$

$$= \frac{10h + 3h^2}{h}$$

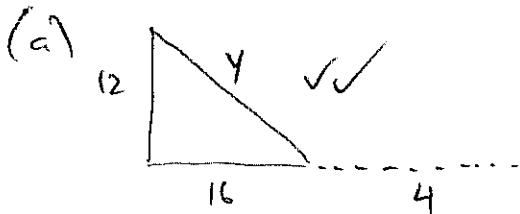
$$= \frac{h(10+3h)}{h}$$

$$= \boxed{10+3h}$$

2. (10 points) A bird is on an island (at point A) and wants to fly to its nest (at point N) on the mainland. The island lies 12 miles from point B , which is the closest point on the shore, and the coastline is straight the whole way up to the nest, which is 20 miles along the shore from point B . The bird is going to fly over the water in a straight line from point A to some point L on the shoreline, and then fly straight to the nest. When flying over water the bird uses 15 calories/mile of energy, and when flying over land only uses 8 calories/mile. See the diagram below, then answer the questions.



- (a) Suppose the bird flies to the point L and the distance from B to L is 16 miles. How much energy does the bird use total to fly from the island to the nest?
- (b) Suppose the bird flies to the point L and the distance from B to L is x miles. How much energy does the bird use total to fly from the island to the nest? Write your answer as an expression in terms of x .



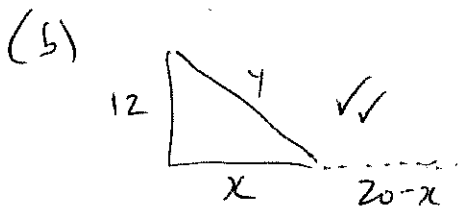
$$12^2 + 16^2 = y^2 \quad \checkmark \checkmark$$

$$144 + 256 = y^2$$

$$\sqrt{400} = \sqrt{y^2}$$

$$y = 20$$

\Rightarrow energy is $15 \cdot (20) + 8 \cdot 4 = \boxed{332 \text{ calories}}$



$$12^2 + x^2 = y^2 \quad \checkmark \checkmark$$

$$\sqrt{144 + x^2} = y$$

\Rightarrow energy is $\boxed{(\sqrt{144 + x^2})(15) + (20 - x)8}$

5

2

Extra Credit(1 point) Suppose that the bird in question (??) wants to use the *least* amount of energy possible to get from the island to the nest. How would you go about figuring out what path it should take? You do not need to find that path, you just need to explain what math you would do in order to figure it out.

Graph the function from the question

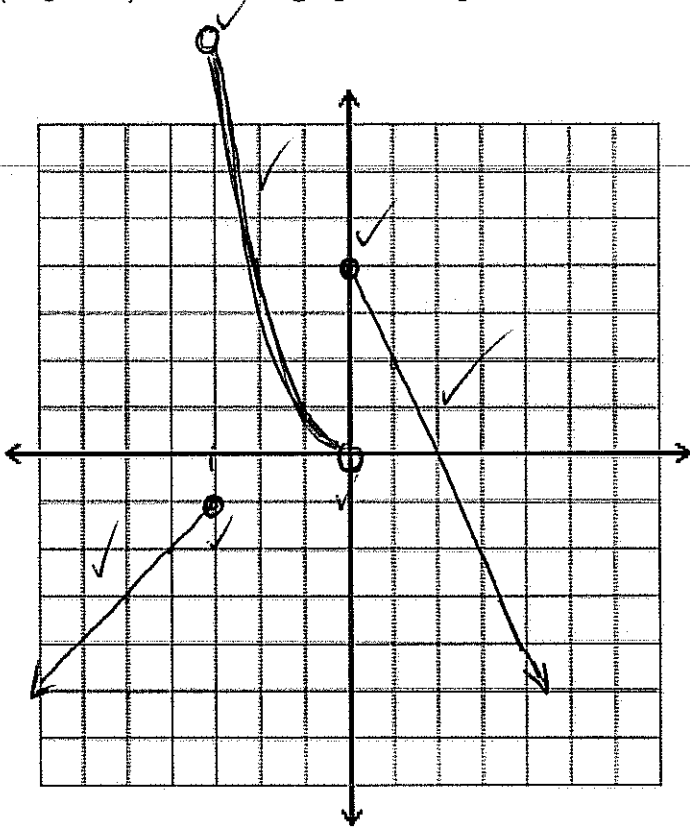
$$y = (\sqrt{144 + x^2}) \cdot 15 + (20 - x) \cdot 8$$

and find the lowest point (the local min).

That is the x -value you need to tell you

where it should hit the land.

3. (10 points) Sketch the graph of the piecewise function $f(x) = \begin{cases} x+2 & \text{if } x \leq -3 \\ x^2 & \text{if } -3 < x < 0 \\ 4-2x & \text{if } x \geq 0 \end{cases}$

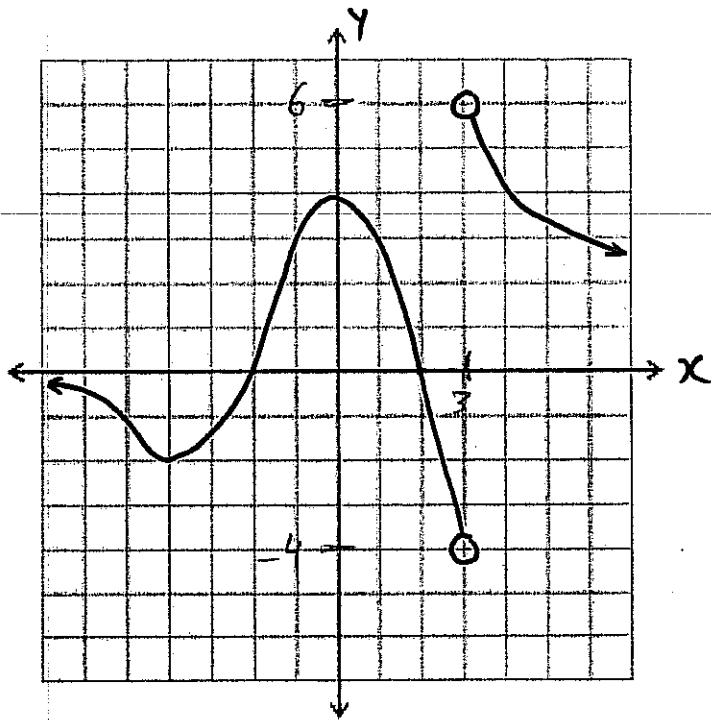


x	y
-3	-1
-4	-2
-5	-3

x^2	y
-3	9
-2	4
-1	1
0	0

x	y
0	4
1	2
2	0

4. (10 points) Consider graph of the function $f(x)$ below. Assume each square of the grid is one unit.



- (a) Find the domain of f .
 (b) Find the range of f .
 (c) Find the (x, y) -coordinates of all local maximum(s) and minimum(s).
 (d) On what interval(s) is the function decreasing?
 (e) Find the average rate of change of $f(x)$ from $x = -4$ to $x = 1$.

(a) domain is $(-\infty, 3), (3, \infty)$ ✓

(b) range is $(-4, 6)$ ✓

(c) local min at $(-4, -2)$, max at $(0, 4)$ ✓

(d) decreasing on $(-\infty, -4), (0, 3)$ and $(3, \infty)$ ✓

(e) $f(-4) = -2$

$f(1) = 3$

$$\frac{-2 - 3}{-4 - 1} = \frac{-5}{-5} = \boxed{1} \quad \checkmark$$

and C
Minitest 1B - MTH 1210

Dr. Graham-Squire, Fall 2013

Name: _____

Key

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(signature)

DIRECTIONS

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5. Give all answers in exact form, not decimal form (that is, put π instead of 3.1415, $\sqrt{2}$ instead of 1.414, etc) unless otherwise stated.
6. Make sure you sign the pledge.
7. Number of questions = 4. Total Points = 40.

1. (10 points) Find the average rate of change for the function $f(x) = 4x^2 - x$ from $x = 3$ to $x = 3 + h$.

$$\begin{aligned} f(3+h) &= 4(3+h)^2 - (3+h) \\ &= 4(9+6h+h^2) - 3-h \\ &= 36+24h+4h^2-3-h = 4h^2+33+23h \end{aligned}$$

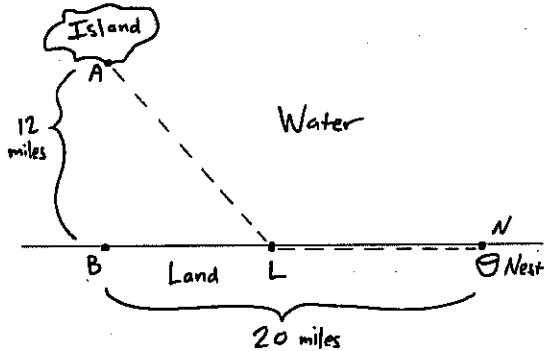
$$f(3) = 4(3^2) - 3 = 36 - 3 = 33$$

$$\frac{f(3+h) - f(3)}{3+h-3} = \frac{4h^2+23h+\cancel{33} - \cancel{33}}{h}$$

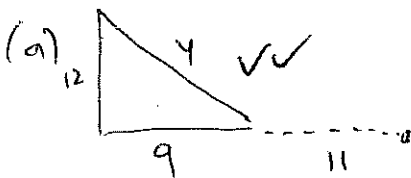
$$= \frac{h(4h+23)}{h}$$

$$= \boxed{4h+23}$$

2. (10 points) A bird is on an island (at point A) and wants to fly to its nest (at point N) on the mainland. The island lies 12 miles from point B , which is the closest point on the shore, and the coastline is straight the whole way up to the nest, which is 20 miles along the shore from point B . The bird is going to fly over the water in a straight line from point A to some point L on the shoreline, and then fly straight to the nest. When flying over water the bird uses 15 calories/mile of energy, and when flying over land only uses 8 calories/mile. See the diagram below, then answer the questions.



- (a) Suppose the bird flies to the point L and the distance from B to L is 9 miles. How much energy does the bird use total to fly from the island to the nest?
- (b) Suppose the bird flies to the point L and the distance from B to L is x miles. How much energy does the bird use total to fly from the island to the nest? Write your answer as an expression in terms of x .



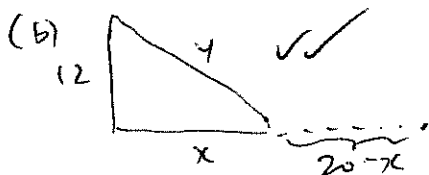
$$12^2 + 9^2 = y^2 \quad \checkmark$$

$$144 + 81 = y^2$$

$$y = \sqrt{225} = 15$$

5

\Rightarrow Energy used is $15 \cdot 15 + 11 \cdot 8 = 225 + 88 = 313$ calories



$$y^2 = 12^2 + x^2 \quad \checkmark$$

$$y = \sqrt{144 + x^2}$$

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\Rightarrow Energy used is

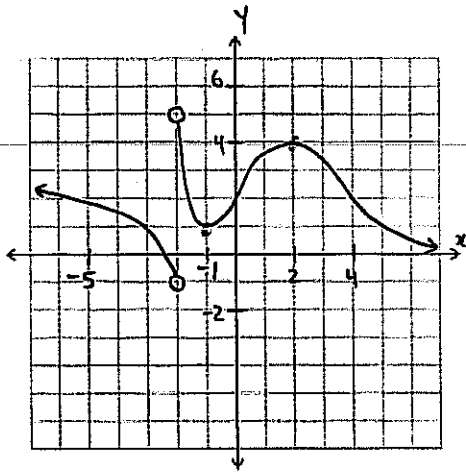
$$15(\sqrt{144 + x^2}) + 8(20 - x)$$

2

Extra Credit(1 point) Suppose that the bird in question (2?) wants to use the *least* amount of energy possible to get from the island to the nest. How would you go about figuring out what path it should take? You do not need to find that path, you just need to explain what math you would do in order to figure it out.

Graph the function from 2(b), and look for the local minimum point. The x -value you get tells you ~~the~~ the point on the shore where the bird should land.

3. (10 points) Consider graph of the function $f(x)$ below. Assume each square of the grid is one unit.



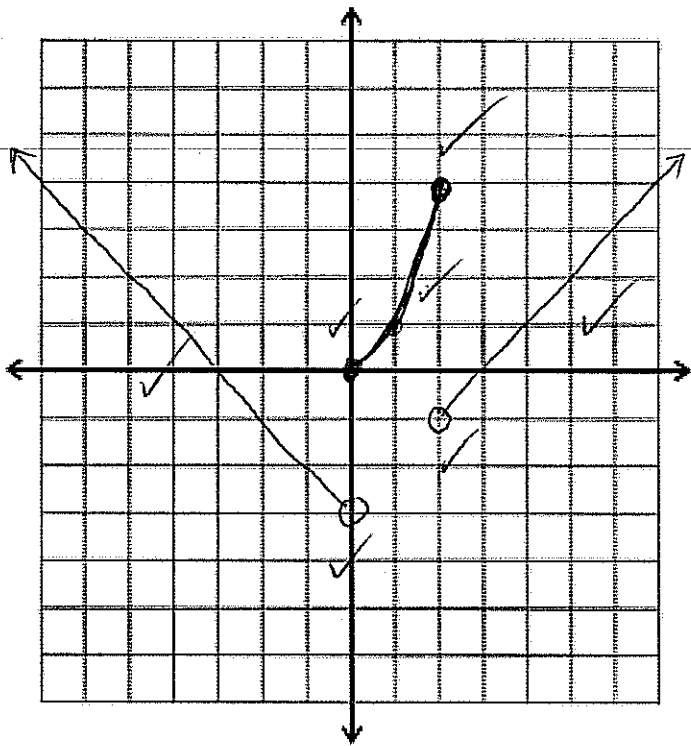
- (a) Find the domain of f . $= (-\infty, -2), (-2, \infty)$ 2
 (b) Find the range of f . $= (-1, 5)$ 2
 (c) Find the (x, y) -coordinates of all local maximum(s) and minimum(s).
 (d) On what interval(s) is the function decreasing?
 (e) Find the average rate of change of $f(x)$ from $x = -1$ to $x = 4$.

(c) Local min at $(-1, 1)$, max at $(2, 4)$ 2

(d) decreasing on $(-\infty, -2)$, $(-2, -1)$, and $(2, \infty)$ 2

(e) $f(-1) = 1$
 $f(4) = 2$
 $\frac{f(4) - f(-1)}{4 - (-1)} = \frac{2 - 1}{5} = \boxed{\frac{1}{5}}$ 2

4. (10 points) Sketch the graph of the piecewise function $f(x) = \begin{cases} -3-x & \text{if } x < 0 \\ x^2 & \text{if } 0 \leq x \leq 2 \\ x-3 & \text{if } x > 2 \end{cases}$



$$-3-x=y$$

x	y
0	-3
-1	-2
-2	-1

$$y=x^2$$

x	y
0	0
1	1
2	4

$$y=x-3$$

x	y
2	-1
3	0
4	1