

Math 120 (Collingwood)  
19 October 2000  
Midterm #1 (50 points)

Name \_\_\_\_\_

TA: \_\_\_\_\_

Section: \_\_\_\_\_

Student Number: \_\_\_\_\_

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Instructions:

- Your exam contains 3 problems. The entire exam is worth 50 points. The point value of each problem is clearly marked.
- Your exam should contain 6 pages; please make sure you have a complete exam.
- Box in your final answer when appropriate. Use the back of your exam pages if you need extra room.
- When appropriate, carry out calculations to at least two decimal places.
- You have 50 minutes for this midterm. You **MUST** show work for credit. No credit for answers only (unless stated otherwise). No graphing calculators are allowed. If in doubt, ask for clarification.
- Make sure to do your own work on the exam.
- Please sign the exam. In doing so, you understand that we may make photocopies of some exams prior to returning.

Signature \_\_\_\_\_

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Problem #1 (20 pts) \_\_\_\_\_

Problem #2 (15 pts) \_\_\_\_\_

Problem #3 (15 pts) \_\_\_\_\_

TOTAL (50 pts) \_\_\_\_\_

1. (20 pts) Short Answer and calculations.

(a) (8pts) Let  $y = f(x) = 3x^2 - x + 1$ . Simplify the expression so there is no " $h$ " in the denominator:

$$\frac{f(x+h) - f(x)}{h} =$$

(b) (4pts) Let  $y = g(x) = \sqrt{x^4 + 2x^2 + 3}$ ,  $P = (0, 1)$  and  $Q$  is the point on the graph of  $g(x)$  having  $x$ -coordinate 1. Does the line connecting  $P$  and  $Q$  have positive or negative slope? (You must justify; no credit for answer only.)

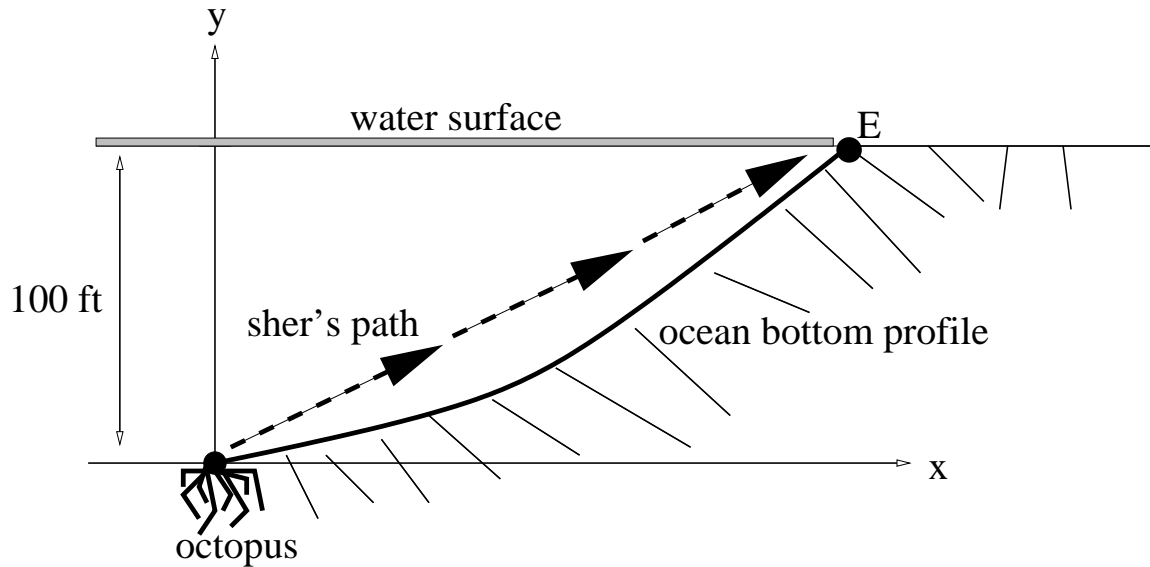
(c) (4pts) Let  $h(x) = \frac{1}{3}x + 1$ . Find the formula for the rule of

$$h(h(x)) =$$

(d) (4pts) Does the line with equation  $y = -x + 1$  intersect the graph of the quadratic function  $y = x^2 - 2x + 3$ ?

2. (15 pts) Sher is scuba diving. She is 100 ft. below the surface of the water observing an octopus. She is low and air and begins swimming to the surface along the pictured path; she swims along a straight line from the octopus to the edge of the water at  $E$ . Impose coordinates as pictured with the octopus as the origin; this is a two-dimensional side view of the situation, not to scale. The profile of the ocean bottom is the graph of

$$y = \frac{x^2}{400}, \quad x \geq 0$$



- (a) (2pts) Find the coordinates of  $E$ .
- (b) (2pts) Find the rule and domain of the function whose graph will model Sher's path from the octopus to  $E$ .
- (c) (3pts) Find a function  $h(x)$  that calculates Sher's vertical height above the ocean bottom as she moves along the her path.

(d) (5pts) Find Sher's location (coordinates) when she has maximum vertical height above the ocean bottom.

(e) (1pts) Sher has vertical visibility of  $\pm 20$  feet (i.e. she can see up or down 20 feet vertically). As Sher swims along her path, will she ever lose vertical sight of the ocean bottom?

(f) (2pts) Sher's dive computer indicates her vertical depth below the surface is decreasing at a constant rate of 5 ft/min. When is Sher 20 feet below the surface of the water? Where is she located when this occurs? (Give her coordinates.)

3. (15 pts)

- (a) (8pts) Let  $y = f(x) = -\sqrt{1 - (x - 1)^2}$  on the domain  $0 \leq x \leq 2$ ; the graph of  $f(x)$  is a lower semicircle. Find the rule, the largest possible domain and sketch the graph of

$$b(x) = 0.1f(0.5x) + 1.$$

- (b) (7pts) During surgery, one member of the operating team must monitor the patient blood oxygen level. Assume this blood oxygen level after  $x$  hours is given by the function  $b(x)$  in part (a). Kidney damage can occur if the blood oxygen level drops below 0.92 for more than 2 hours. Find the total amount of time this patient has a blood oxygen level below 0.92.