

Math103 Final Exam Spring 2017

At a recent meeting of the Council of Undergraduate Deans, members of the student Honor Council proposed that in order to promote a culture of academic integrity at Penn, faculty request students to sign a statement that they are aware of and have abided by the Code of Academic Integrity in the completion of assignments, papers and exams.

My signature below certifies that I have complied with the University of Pennsylvania's Code of Academic Integrity in completing this (examination)(paper).

Name (printed)

Signature

Date

Problem	Points	Problem	Points
1	/10	7	/10
2	/10	8	/10
3	/10	9	/10
4	/20	10	/10
5	/10	11	/10
6	/10	12	/10

Total /130

Each question is worth 10 points with the exception of problem 4 which is 20 points. Partial credit will be given for the entire exam, so be sure to show your work and write clearly. On a multiple choice question, support your answer. If there is no work or justification you will receive little to no credit.

1. Evaluate the indefinite integral $\int \frac{4(\ln x)^3}{x} dx$

2. Suppose h is a function such that $h(1) = -2$, $h'(1) = 2$, $h''(1) = 3$, $h(2) = 6$, $h'(2) = 5$, $h''(2) = 13$ and h'' is

continuous everywhere. Evaluate $\int_1^2 h''(u) du$.

(10)

3. Evaluate the following limit, if it exists $\lim_{x \rightarrow 1} \frac{\sqrt{x} - x^2}{1 - \sqrt{x}}$

(10)

4. Graph $f(x) = x + \frac{1}{x}$ [**NOTE:** Some questions may not have an answer]

A) Determine the domain.

(1)

B) Find the critical point(s).

(3)

C) Find the x and y intercept(s).

(1)

D) Does $f(x)$ have any symmetry? If yes, then to what?

(2)

E) Does $f(x)$ have any asymptotes? If yes, where and what type?

F) On which interval(s) is $f(x)$ increasing/decreasing.

(3)

G) Is/are there any max(s)/ min(s)? If yes, identify the coordinates and label them as max or min.

(2)

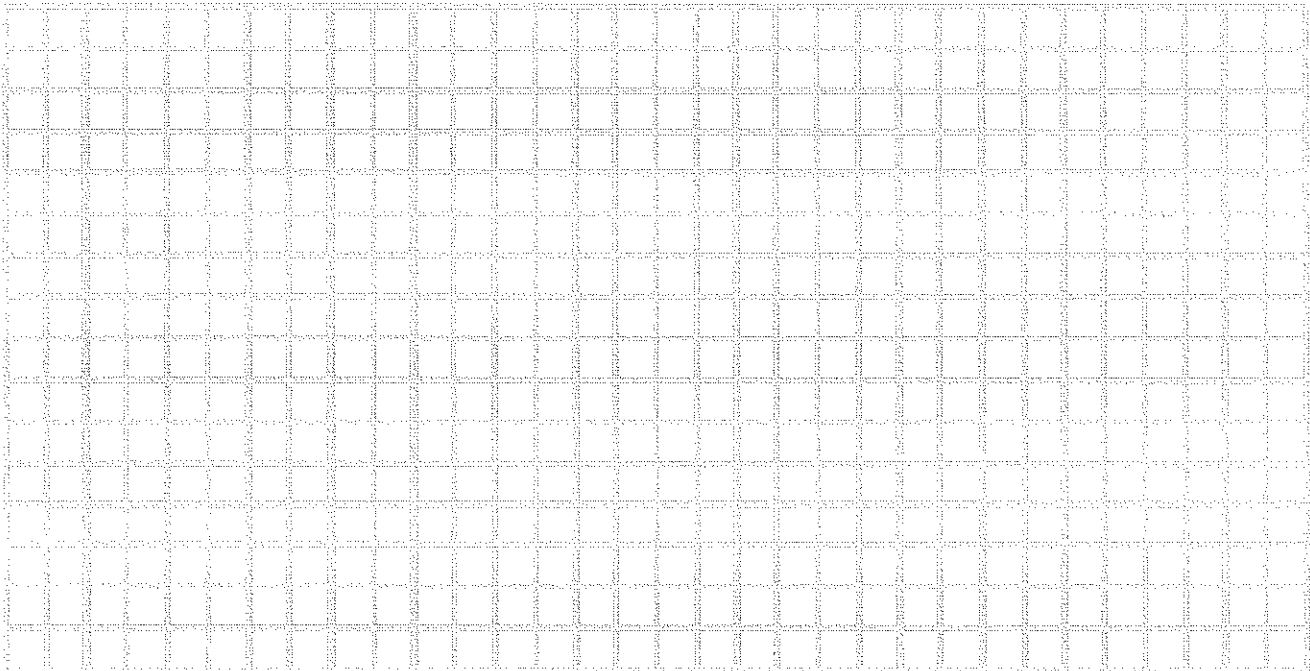
H) Are there any point(s) of inflection? If so, what are they?

(2)

(2)

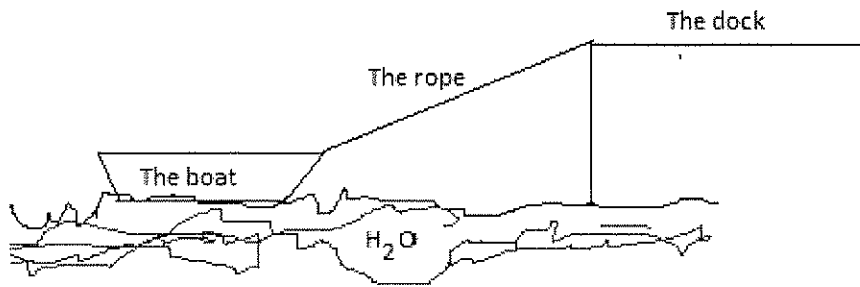
1) Graph the function.

(4)



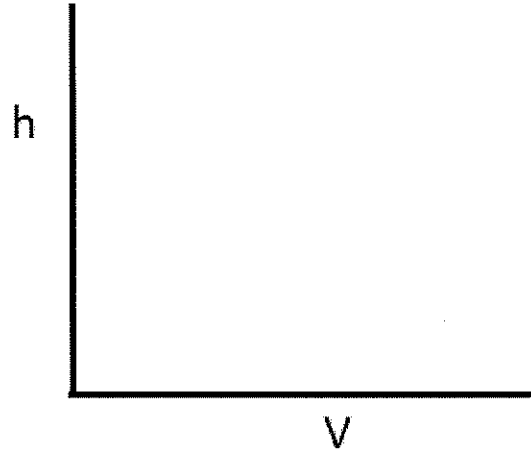
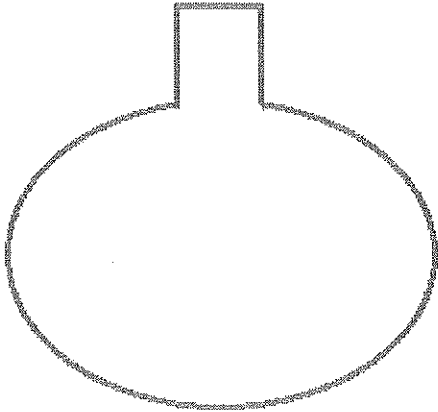
5. Evaluate $\lim_{x \rightarrow 4^+} \frac{4-x}{|4-x|}$

6. A boat is pulled into a dock by a rope attached to the bow of the boat and passing through a pulley on the dock that is 1 meter higher than the bow of the boat. If the rope is pulled in at a rate of 1 m/s, how fast is the boat approaching the dock when it is 8 meters from the dock?



(10)

7. Water is flowing into the bottle at a constant rate. Sketch a graph that would show the relationship between the level h of the water in cm , and the volume of the water, V , in cm^3 in the bottle. That is sketch a graph of h versus V .



8. A box with a square base and an open top must have a volume of $32,000 \text{ cm}^3$. Find the dimensions of the box that minimize the amount of material used.

9. Choose an equation from the following that expresses the fact that a function f is continuous at the number 6. [**You must explain your reasoning**]

a) $\lim_{x \rightarrow \infty} f(x) = 6$

b) $\lim_{x \rightarrow 6} f(x) = f(6)$

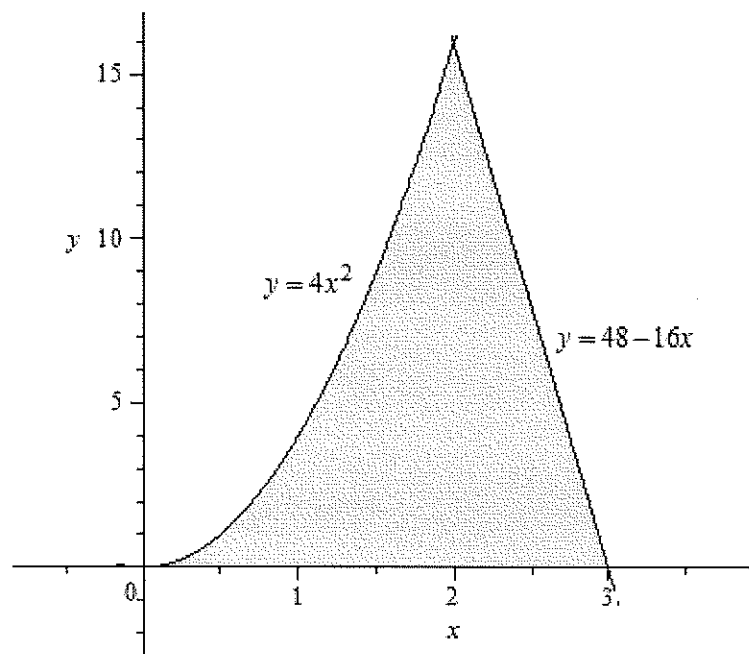
c) $\lim_{x \rightarrow \infty} f(x) = f(6)$

d) $\lim_{x \rightarrow 6} f(x) = 0$

e) $\lim_{x \rightarrow \infty} f(x) = \infty$

10. Evaluate the indefinite integral $\int \frac{7+x}{9+x^2} dx$

11. Find the area of the shaded region.



12. Determine the equation of the tangent line to the curve $x^2 + xy - y^2 = 1$ at $(2, 3)$.