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001

# Math 113 Exam 2

Mar 1-3, Late Day Mar 4,  
2016

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

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

Instructor: \_\_\_\_\_

Encode your BYU ID in the grid below.

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### Instructions

- I) Do not write on the barcode area at the top of each page, or near the four circles on each page.
- II) Fill in the correct boxes for your BYU ID and for the correct answer on the multiple choice completely. Multiple choice questions are 4 points each.
- III) For questions which require a written answer, show all your work in the space provided and justify your answer.
- IV) Simplify your answers.
- V) No books, notes, or calculators of any type are allowed.
- VI) There is no time limit on this exam.



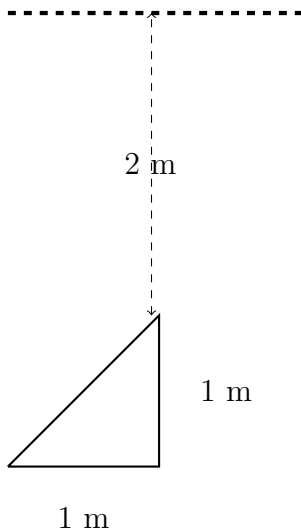
**FERPA Permission:** Please indicate whether you give permission for your exam to be returned to you by email. This question **supersedes** any permission you have given previously. Please answer it correctly. No score will be assigned to this question. **Note: If you choose not to give permission, you will need to discuss with your instructor how you will get your exam.**

No, I do not give permission.

Yes, I give permission.

**Part I: Multiple Choice Questions:** *Mark the correct answer. (4 points each)*

1 A flat plate in the shape of a right isosceles triangle with side length 1 m is submerged vertically 2 m as in the picture. What is the hydrostatic force on one side of the plate? (The weight density of the liquid will be given as  $\rho g$ .)



$\rho g$

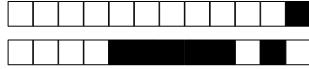
$4\rho g$

$\frac{1}{3}\rho g$

$\frac{2}{3}\rho g$

$\frac{4}{3}\rho g$

$2\rho g$



2 The function  $y = 3x^2$  from  $x = 1$  to  $x = 3$  is rotated about the  $x$ -axis. Choose the integral that represents the area of the resulting surface.

$\int_1^3 2\pi x \sqrt{1 + (6x)^2} dx$

$\int_1^3 2\pi(3x^2) \sqrt{1 + (3x^2)^2} dx$

$\int_1^3 2\pi(3x^2) \sqrt{1 - (6x)^2} dx$

$\int_1^3 2\pi x \sqrt{1 + (3x^2)^2} dx$

$\int_1^3 2\pi(3x^2) \sqrt{1 + (6x)^2} dx$

$\int_1^3 2\pi(3x^2) \sqrt{1 - (3x^2)^2} dx$

3 Find an integral that represents the length of the curve  $y = \ln(\sec x)$ ,  $\pi/6 \leq x \leq \pi/3$ .

$\int_{\pi/6}^{\pi/3} \sqrt{1 + \cos^2 x} dx$

$\int_{\pi/6}^{\pi/3} \sin x dx$

$\int_{\pi/6}^{\pi/3} \sqrt{1 - \tan^2 x} dx$

$\int_{\pi/6}^{\pi/3} \sqrt{1 - \sec^2 x} dx$

$\int_{\pi/6}^{\pi/3} \sec x dx$

$\int_{\pi/6}^{\pi/3} \sqrt{1 + \sec^2 x} dx$



4 Write the correct format for a partial fraction decomposition of the following function:

$$\frac{3x^2 + 4x + 5}{x^4 - 1}$$

$\frac{A}{x^2 + 1} + \frac{B}{x + 1} + \frac{C}{x - 1}$

$\frac{Ax}{x^2 + 1} + \frac{Bx}{x + 1} + \frac{C}{x - 1}$

$\frac{Ax + B}{x^2 + 1} + \frac{C}{x + 1} + \frac{D}{x - 1}$

$\frac{Ax}{x^2 + 1} + \frac{B}{x + 1} + \frac{C}{x - 1}$

5 For what value of  $a$  is the function

$$f(x) = \frac{a}{x^2}, \quad 1 \leq x \leq 2,$$

a probability density function? (You may assume  $f(x) = 0$  for  $x < 1$  or  $x > 2$ .)

1

0

4

No choice of  $a$  will make the above function a probability density function.

$\frac{1}{2}$

2



6 Which of the following would be an appropriate function to use in the comparison theorem when trying to prove that  $\int_1^\infty \frac{x \sin^2 x}{\sqrt{x^6 + x}} dx$  converges?

$\frac{\sin x}{x^2}$

$\frac{1}{x^2}$

$\frac{1}{x^7}$

$\frac{1}{x}$

$\frac{\sin x}{x}$

$\frac{1}{\sqrt{x}}$

7 Integrate the following function:

$$\int t \sin(t) \cos(t) dt$$

$\frac{-t \cos(2t)}{8} + \frac{\sin(2t)}{4} + C$

$\frac{-t \cos(2t)}{4} + \frac{\sin(2t)}{8} + C$

$\frac{t \cos(2t)}{4} + \frac{\sin(2t)}{8} + C$

$\frac{-t \cos(2t)}{2} + \frac{\sin(2t)}{4} + C$



8 Find the following integral:

$$\int \frac{1}{x^2 + 2x + 4} dx$$

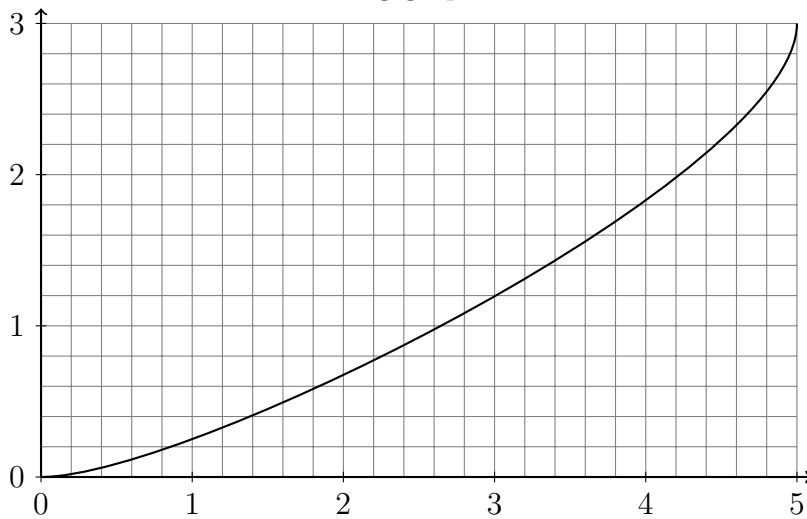
$\sqrt{3} \arctan\left(\frac{x+1}{\sqrt{3}}\right) + C$

$\sqrt{3} \arctan\left(\frac{\sqrt{3}}{x+1}\right) + C$

$\frac{1}{\sqrt{3}} \arctan\left(\frac{x+1}{\sqrt{3}}\right) + C$

$\frac{1}{\sqrt{3}} \arctan\left(\frac{\sqrt{3}}{x+1}\right) + C$

9 Consider the following graph:



Apply Trapezoid with  $n = 5$  to approximate the area under the curve. Which of the following is closest to the estimate?

5.5

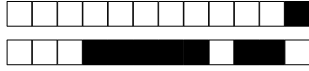
3

11

7.75

2.25

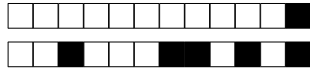
5



+1/7/54+

10 A region lies between the curves given by  $y = 0$ ,  $y = x^3$ ,  $x = 1$ , and  $x = 2$ . Find the  $x$  coordinate of the centroid,  $\bar{x}$ .

- $\frac{93}{4}$
- $\frac{124}{75}$
- $\frac{254}{115}$
- $\frac{31}{5}$
- $\frac{15}{4}$
- $\frac{127}{14}$



+1/8/53+

**Part II:** *Justify your answer and show all work for full credit.*

11

0  1  2  3  4  5  6  7  8 **DON'T MARK**

Evaluate the integral  $\int_0^1 \frac{1}{\sqrt{1-x}} dx$





+1/9/52+

12

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Find the length of the curve given by  $y = \frac{x^2}{4} - \frac{1}{2} \ln x$  from  $x = 1$  to  $x = 2$ .

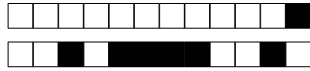


+1/10/51+

13

0 1 2 3 4 5 6 7 8 DON'T MARK

Show that the surface area that results from rotating the infinite curve  $y = \frac{1}{x^2}$ ,  $1 \leq x < \infty$  about the  $x$ -axis is finite.



+1/11/50+

14

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Consider the integral

$$\int_0^2 3e^{-2x} dx.$$

If you approximate the above integral with the Midpoint rule, how many intervals are necessary so that the error is no more than  $10^{-4}$ ? Recall that the error bound for Midpoint is given by

$$|E_M| \leq \frac{M(b-a)^3}{24n^2}.$$



+1/12/49+

15

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Find

$$\int_1^2 \frac{3x^2 - x - 5}{(x - 2)(x^2 + 1)} dx$$

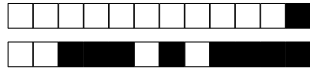


+1/13/48+

16

0 1 2 3 4 5 6 7 8 9 10 DON'T MARK

Find the centroid of the region between  $x = y^2 + 3y + 1$  and  $x = 2y + 3$ .



+1/14/47+

17

0 1 2 3 4 5 6 7 8 DON'T MARK

Find the mean of the probability distribution whose probability density function is

$$f(x) = \frac{x^2 - x}{54}, 0 \leq x \leq 6.$$