



NS



001

Math 113
Exam 1
October 9-11, 2017

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.
- III) Fill in the correct answer on the multiple choice completely. Multiple choice questions are 5 points each.
- IV) Multiple choice questions that have more than one correct answer will be marked with a ♣. All other multiple choice questions have only one correct answer.
- V) For questions which require a written answer, show all your work on the same page as the question, and justify your answer. Any work written on other pages will not be seen by the grader.
- VI) Simplify your answers.
- VII) Scientific calculators are allowed.
- VIII) No books or notes are allowed.
- IX) There is no time limit on this exam.



Part I: Multiple Choice Questions: *Maximum 5 points each. Questions marked with a ♣ have more than one correct answer. Mark **all** correct answers. The other questions have one correct answer.*

1 ♣ Which of the following **incorrectly** applies the Fundamental Theorem of Calculus? (This question has more than one correct answer. Mark all correct answers.)

$\int_0^{\pi/4} \sec x \, dx = \ln \cos x \Big|_0^{\pi/4}$

$\frac{d}{dx} \int_0^{1+2x} e^t \sin^2 t \, dt = 2e^{1+2x} \sin^2(1+2x)$

$\int_0^\pi x \cos(x^2) \, dx = \frac{\sin(x^2)}{2} \Big|_0^\pi$

$\frac{d}{dx} \int_x^0 \cos t \, dt = -\cos x$

$\int_{-1}^1 \frac{1}{x^2} \, dx = -\frac{1}{x} \Big|_{-1}^1$

2 The value of

$$\int_0^1 \frac{x}{\sqrt{2x^2+3}} \, dx$$

is

$\frac{1}{4}$

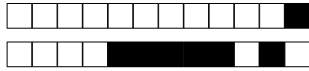
$\frac{\sqrt{3}-\sqrt{1}}{4}$

$\frac{\sqrt{5}+\sqrt{1}}{2}$

$\frac{1}{2}$

$\frac{\sqrt{5}+\sqrt{3}}{4}$

$\frac{\sqrt{5}-\sqrt{3}}{2}$



3 A spring has a natural length of 50 cm. If a force of 20 N is required to keep the spring stretched to 60 cm, how much work is done in stretching the spring from its natural length to 60 cm? [Be careful with units.]

- 0.5 J
- 10 J
- 50 J
- 100J
- 1 J

4 For $f(x) = 3x^2$, find the value of c in $[0, 3]$ for which $f(c)$ equals the average value of f over $[0, 3]$.

- $\sqrt{3}$
- $\sqrt{2}$
- $-\sqrt{3}$
- $1/3$
- 0
- 3



5 The value of

$$\int_0^1 x e^{-x} dx$$

is

$1 - 2e^{-1}$

$1 - e^{-1}$

1

$1 + 2e^{-1}$

$1 + e^{-1}$

6 The substitution $u = \cos x$ converts the integral

$$\int \sin^5 x \cos^4 x dx$$

into

$-\int (1 - u^2)^2 u^4 du$

$-\int u^8 du$

$-\int ((1 + u^2)^4 u^2 du$

$-\int ((1 - u^2)^4 u^2 du$

$-\int (1 + u^2)^2 u^4 du$



- 7 Which substitution leads to the simplification

$$\int \frac{\sqrt{x^2 - 4}}{x^3} dx = \frac{1}{2} \int \sin^2 \theta d\theta?$$

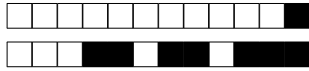
- $x = 2 \sec \theta$
 $x = 4 \sec \theta$
 $x = 2 \tan \theta$
 $x = \frac{1}{2} \sec \theta$
 $x = 4 \tan \theta$
 $x = \frac{1}{2} \tan \theta$

- 8 A partial fraction decomposition for

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

is

- $\int \left(\frac{A}{x+1} + \frac{Bx+C}{x-1} \right) dx$
 $\int \left(\frac{A}{x+1} + \frac{B}{x-1} + \frac{C}{x-1} \right) dx$
 $\int \left(\frac{A}{x+1} + \frac{B}{x-1} \right) dx$
 $\int \left(\frac{A}{x+1} + \frac{B}{x-1} + \frac{C}{(x-1)^2} \right) dx$

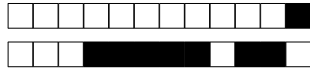


+1/6/55+

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

9 0 1 2 3 4 5 6 7 8 9 10 *Administrative Use Only*

Find the area enclosed by the curves $x = y^2 - 4y$ and $x = 2y - y^2$.



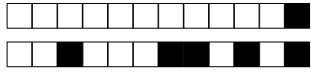
10 0 1 2 3 4 5 6 7 8 9 10 *Administrative Use Only*

Let S be the solid obtained by revolving about the x -axis the region R bounded by $y = \sqrt{x}$, $x = 0$, and $y = 2$.

(a) Sketch the region R .

(b) Use the method of washers to find the volume of S .

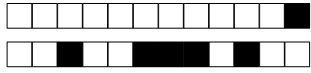
(c) Use the method of cylindrical shells to find the volume of S .



+1/8/53+

11 0 1 2 3 4 5 6 7 8 9 10 *Administrative Use Only*

A rope weighing 0.5 lb/ft is used to lift 40 lb of water up a 25 ft deep well. Find the work done.

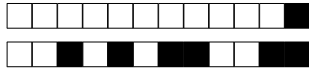


+1/9/52+

12 0 1 2 3 4 5 6 7 8 9 10 *Administrative Use Only*

Evaluate the integral

$$\int \tan^4(x) \sec^4(x) dx.$$

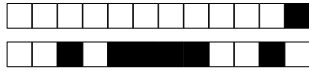


+1/10/51+

13 0 1 2 3 4 5 6 7 8 9 10 *Administrative Use Only*

Evaluate

$$\int \frac{1}{x^2\sqrt{9+x^2}} dx.$$



+1/11/50+

14 0 1 2 3 4 5 6 7 8 9 10 *Administrative Use Only*

Evaluate

$$\int \frac{x-1}{x^2+3x+2} dx.$$