

MAC 1147  
Fall 2021

**EXAM 3A**

- A. Sign and date your scantron on the back at the bottom.
- B. In pencil, write and encode in the spaces indicated on your scantron:
- 1) Name (last name, first initial, middle initial)
  - 2) UF ID Number
  - 3) Section Number — Do not fill this out.
- C. Under “special codes” on your scantron, code in the test ID number 3, 1.
- |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | ● | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| ● | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
- D. At the top right of your scantron, for “Test Form Code”, encode A.
- B C D E
- E. 1) This exam has 23 multiple-choice questions and 2 free response questions. Each question has equal weight.
- 2) The time allowed is 90 minutes.
- 3) You may write on the test.
- 4) Raise your hand if you need more scratch paper or if you have a problem with your test. **DO NOT LEAVE YOUR SEAT UNLESS YOU ARE FINISHED WITH THE TEST.**
- F. **KEEP YOUR SCANTRON COVERED AT ALL TIMES.**
- G. When you are finished:
- 1) Before turning in your test, check for transcribing errors. Any mistakes you leave in are there to stay.
  - 2) Take your test, scratch paper, and scantron to your TA. Be prepared to show your UF ID card.
  - 3) Answers will be posted in Canvas after the exam.
- H. By taking this exam, you agree to the following **Honor Pledge**:

**“I will neither give nor receive any unauthorized aid for this exam.”**

Questions 1–23 are worth 4 points each.

1. The size of a quantity after  $t$  days is given by  $A(t) = 200 \cdot (1.08)^t$ . What is the effective growth rate of the quantity?

A. 108% per day                      B. 92% per day                      C. –8% per day  
D. –92% per day                      E. 8% per day

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2. Select the expression that is equivalent to

$$\log_b \left( \frac{8x^7}{yz^4} \right)$$

A.  $7 \log_b x - \log_b y - 4 \log_b z + \log_b 8$   
B.  $7 \log_b x + \log_b y - 4 \log_b z + \log_b 8$   
C.  $7 \log_b x - \log_b y + 4 \log_b z + \log_b 8$   
D.  $7 \log_b x - \log_b y + 4 \log_b z - 7 \log_b 8$   
E.  $7 \log_b x - \log_b y - 4 \log_b z + 7 \log_b 8$

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3. Suppose that  $a$  and  $b$  are real numbers such that  $\left(\frac{2}{3}\right)^a < \left(\frac{2}{3}\right)^b < 1$ . Select the statement that *must* be true about  $a$  and  $b$ .

*Hint: Sketch the graph of  $f(t) = \left(\frac{2}{3}\right)^t$*

A.  $a < 0$   
B.  $a > 1$   
C.  $a > b$   
D.  $a + b > 1$   
E.  $a$  considers  $b$  a friend, but  $b$  thinks of  $a$  as more of an acquaintance.

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4.  $\tan\left(\frac{7\pi}{4}\right) =$

A. 1                      B.  $\sqrt{3}$                       C. –1                      D.  $-\sqrt{3}$                       E. 0

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5. Find the sum of all solutions to the equation:

$$(\log_3 x)^2 = 4 \log_3 x$$

- A. 82                      B. 81                      C. 65                      D. 64                      E. 1
- 

6. Identify any vertical asymptotes of the function:

$$f(x) = \log_4(3x - 15) - 2$$

- A.  $x = -2$   
B.  $x = 15$   
C.  $x = \frac{31}{3}$   
D.  $x = 5$   
E.  $f(x)$  has no vertical asymptotes.
- 

7. What is the length of the arc traced along the unit circle by an angle of  $\frac{-2\pi}{3}$ ?

- A.  $\frac{2\pi}{3}$                       B.  $\frac{1\pi}{3}$                       C.  $\frac{-2\pi}{3}$                       D.  $\frac{-1\pi}{3}$                       E.  $\frac{4\pi}{3}$
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8. Suppose that  $f(x) = \log_5(x - 3)$ . Identify the largest interval where  $f(x) < 1$ .

*Hint: Sketch the graph of  $f(x)$*

- A. (3, 28)                      B. (0, 8)                      C. (5, 8)                      D. (3, 8)                      E. (5, 28)
- 

9. Select the angle that is coterminal with  $\theta = \frac{2\pi}{7}$

- A.  $\frac{-12\pi}{7}$                       B.  $\frac{-17\pi}{14}$                       C.  $\frac{9\pi}{7}$                       D.  $\frac{3\pi}{14}$                       E.  $\frac{5\pi}{7}$
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10. Select the statement that is *not* true for all positive  $a, b$ .

A.  $\ln(a + b) = \ln a \cdot \ln b$

B.  $\ln(a^b) = b \ln a$

C.  $\ln(ab) = \ln a + \ln b$

D.  $\ln\left(\frac{a}{b}\right) = \ln a - \ln b$

E.  $\log_b a = \frac{\ln a}{\ln b}$  where  $b \neq 1$

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11. What is the growth factor of the function?

$$g(t) = 65e^{-0.19t}$$

A. 0.81

B.  $e^{-0.19}$

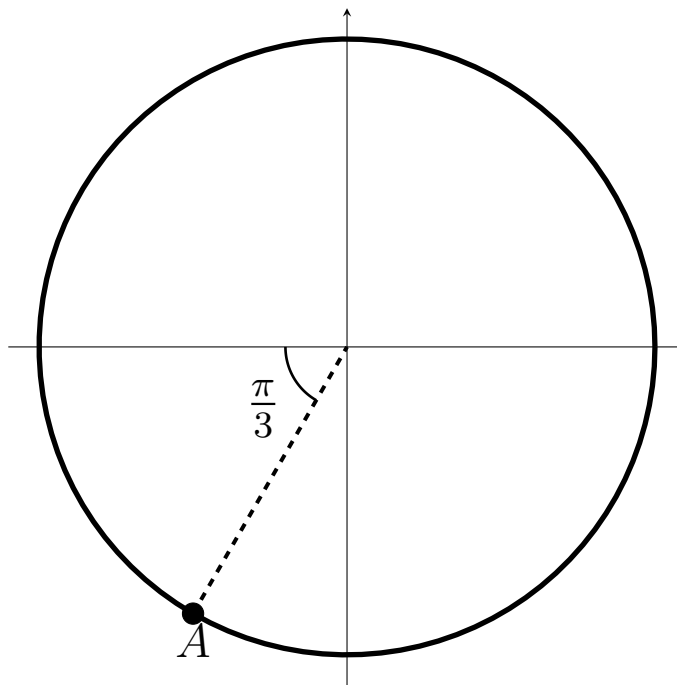
C. -0.19

D. 65

E. 1.19

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12. What are the coordinates of point  $A$ ?



A.  $\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$

B.  $\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$

C.  $\left(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)$

D.  $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

E.  $\left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$

13. What is the domain of the function?

$$f(x) = \log_7(5x - 3)$$

- A.  $(0, \infty)$       B.  $(\frac{3}{5}, \infty)$       C.  $(7, \infty)$       D.  $(\frac{5}{7}, \infty)$       E.  $(3, \infty)$
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14. Suppose that  $\theta$  is an angle in the unit circle with terminal point  $(a, b)$ . Which angle has terminal point  $(-a, -b)$ ?

- A.  $\theta + \frac{3\pi}{2}$       B.  $\theta + \pi$       C.  $\theta + \frac{\pi}{2}$       D.  $\theta + 2\pi$       E.  $\theta + \frac{\pi}{4}$
- 

15. What is the inverse of the function?

$$f(x) = \frac{3^x + 7}{11}$$

- A.  $f^{-1}(x) = 11 \log_3(x) - 7$       B.  $f^{-1}(x) = 11 \log_3(x - 7)$       C.  $f^{-1}(x) = \log_3(11x) - 7$   
D.  $f^{-1}(x) = \log_3(11x - 7)$       E.  $f^{-1}(x) = \log_3(x) - 77$
- 

16. Select the *true* statement.

- A. A quantity with a nominal growth rate of 14% per year will grow more in one year if its growth is compounded 4 times per year than if its growth is compounded 2 times per year.  
B. If  $a$  is positive and  $b > 1$  then  $f(x) = ab^x$  does not have a horizontal asymptote.  
C. The functions  $f(t) = 70e^{24t}$  and  $g(t) = 70e^{29t}$  have the same doubling time.  
D.  $A(t) = Pe^{0.08t}$  models a quantity with an effective growth rate of 8% per year.  
E. If a quantity's growth is compounded more than once per year, then its effective growth rate will be less than its nominal growth rate.
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17. Find the sum of all solutions to the equation.

$$\log_6 x = 2 - \log_6(x + 9)$$

- A. 6      B. -9      C. 3      D. 0      E. 15
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18. A quantity shrinks with a continuous rate of 11% per year. What is its half-life?

- A.  $-\frac{\ln(\frac{1}{2})}{\ln(0.89)}$  years      B.  $-\frac{\ln(\frac{1}{2})}{.11}$  years      C.  $\frac{\ln(\frac{1}{2})}{\ln(0.89)}$  years  
D.  $\frac{\ln(\frac{1}{2})}{.11}$  years      E.  $\frac{\ln(\frac{1}{2})}{\ln(1.11)}$  years
- 

19. Suppose that  $\theta$  is an angle between  $0^\circ$  and  $360^\circ$  and  $\sin(\theta) = \frac{-3}{4}$ . Which of these is a possible value of  $\tan(\theta)$ ?

- A.  $\frac{4}{\sqrt{7}}$       B.  $-\frac{7}{9}$       C.  $\frac{3}{\sqrt{7}}$       D.  $-\frac{\sqrt{7}}{3}$       E.  $\frac{9}{7}$
- 

20. Solve for  $t$ .

$$\log_6(3 \log_5(t)) = 2$$

- A.  $t = 5^{36}$       B.  $t = 6^{\frac{25}{3}}$       C.  $t = 5^{12}$       D.  $t = 6^{25}$       E.  $t = 6^{36}$
- 

21. A wheel with a diameter of 16 inches is spinning. A point on its edge has a linear velocity of  $480\pi$  inches per minute. What is the angular velocity of the wheel in revolutions per minute?

- A. 30 revolutions per minute  
B.  $60\pi$  revolutions per minute  
C.  $30\pi$  revolutions per minute  
D. 60 revolutions per minute  
E. 15 revolutions per minute
-

22. A quantity has initial value  $a$ , and its size after  $t$  minutes is given by  $A(t) = a \cdot (1.13)^t$ . For which value of  $a$  will the quantity double in size fastest?
- A. 80
  - B. 110
  - C. 42
  - D. 7
  - E. The population will take the same amount of time to double for any  $a$ .
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23.  $\log_3 \frac{1}{81} =$

A. 1

B.  $\frac{1}{4}$

C.  $-\frac{1}{4}$

D. 4

E. -4

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T.A. \_\_\_\_\_ Disc. Per. \_\_\_\_\_ Name \_\_\_\_\_

**Honor Pledge: "On my honor, I have neither given nor received unauthorized aid for this exam."**

UF ID # \_\_\_\_\_ Signature \_\_\_\_\_

**YOU MUST SHOW ALL WORK TO RECEIVE FULL CREDIT.**

Free response questions 24-25 are worth 4 points each.

24. Solve for  $x$ . Give exact values, not decimal approximations. You must show your work to receive credit.

$$49^x = 24 - 5 \cdot 7^x$$

$x =$  \_\_\_\_\_



25. An invasive lizard species is causing problems in a local ecosystem. In response, a program to capture and relocate lizards is started. At the start of the project, 256 lizards are observed in the ecosystem. Two years later, the population is measured to be 144.
- a.(2 pts) Construct an exponential function  $P(t)$  that gives the size of the lizard population  $t$  years after the project started.

$P(t) =$  \_\_\_\_\_

- b.(1 pt) According to this model, what will the lizard population be 5 years into the project? Leave your answer in exact form. You do not need to evaluate.

Population= \_\_\_\_\_

- c.(1 pt) According to this model, how long after the project starts will the population be 30 lizards? Give your answer in exact form, not decimal.

\_\_\_\_\_ years