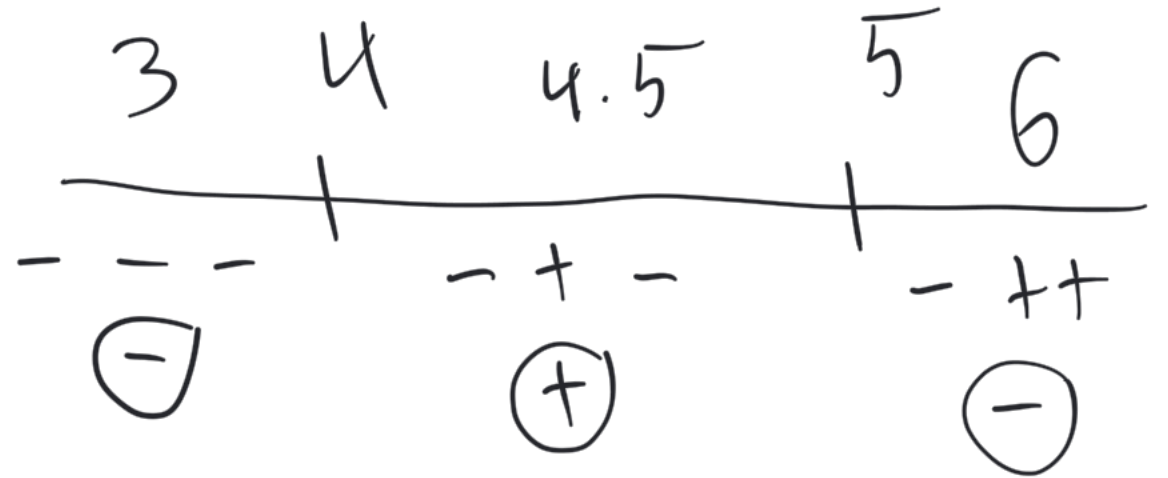


Questions 1–20 are worth 4 points each.

1. Identify the domain of the function $f(x) = \sqrt{-x^2 + 9x - 20}$

$$-x^2 + 9x - 20 \geq 0$$

$$-(x-4)(x-5) \geq 0$$



A. $(4, 5)$

B. $(-\infty, 4) \cup (5, \infty)$

C. $(-\infty, 4] \cup [5, \infty)$

D. $[4, 5]$

E. $[0, \infty)$

2. Which value of k will make the system below inconsistent (parallel lines)?

$$\begin{aligned} y &= -3x + 7 \rightarrow 3x + y = 7 \\ 12x + ky &= 0 \\ (3x + y = 7) \cdot 4 \\ 12x + 4y &= 28 \end{aligned}$$

A. 4

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

C. 0

D. -3

E. $-\frac{1}{3}$

3. Let $f(x) = a^x$ where $a > 0$ and $a \neq 1$. Select statement that is true for all a .

A. $f(x)$ is increasing on $(-\infty, \infty)$.

B. There is at least one number k for which $f(x) = k$ has more than one solution.

C. $f(x) > 0$ for all x

D. $f(1) > f(0)$

E. The equation $f(x) = 0$ has a solution.

4. How many x -intercepts does the function $f(x) = \log_5(5^{2x}) + \log_3\left(\frac{1}{27}\right)$ have?

Hint: Simplify using the properties of logarithms

$$f(x) = 2x \log_5 5 + \log_3\left(\frac{1}{27}\right) = 2x - 3$$

A. 0

B. 1

C. 2

D. 3

E. More than 3

5. Combine into a single logarithmic term:

$$3 \ln x - 7 \ln y + \frac{1}{4} \ln z$$

$$\ln(x^3) - \ln(y^7) + \ln(z^{1/4})$$

A. $\ln\left(3x - 7y + \frac{1}{4}z\right)$

B. $\ln(x^3 - y^7 + \sqrt[4]{z})$

C. $\ln\left(\frac{3xz}{28y}\right)$

D. $\ln\left(\frac{x^3 y^7}{\sqrt[4]{z}}\right)$

E. $\ln\left(\frac{x^3 \sqrt[4]{z}}{y^7}\right)$

6. How many solutions does the equation below have?

$$3xe^{-x} + 9e^{-x} = 0$$

$$e^{-x}(3x+9)=0$$
$$e^{-x}=0$$
$$3x+9=0$$
$$x=-3$$

A. 0

B. 1

C. 2

D. 3

E. More than 3

7. An exponential function has a continuous growth rate of 11%. What is its doubling time?

A. $\ln\left(\frac{2}{0.11}\right)$

B. $\frac{0.11}{\ln 2}$

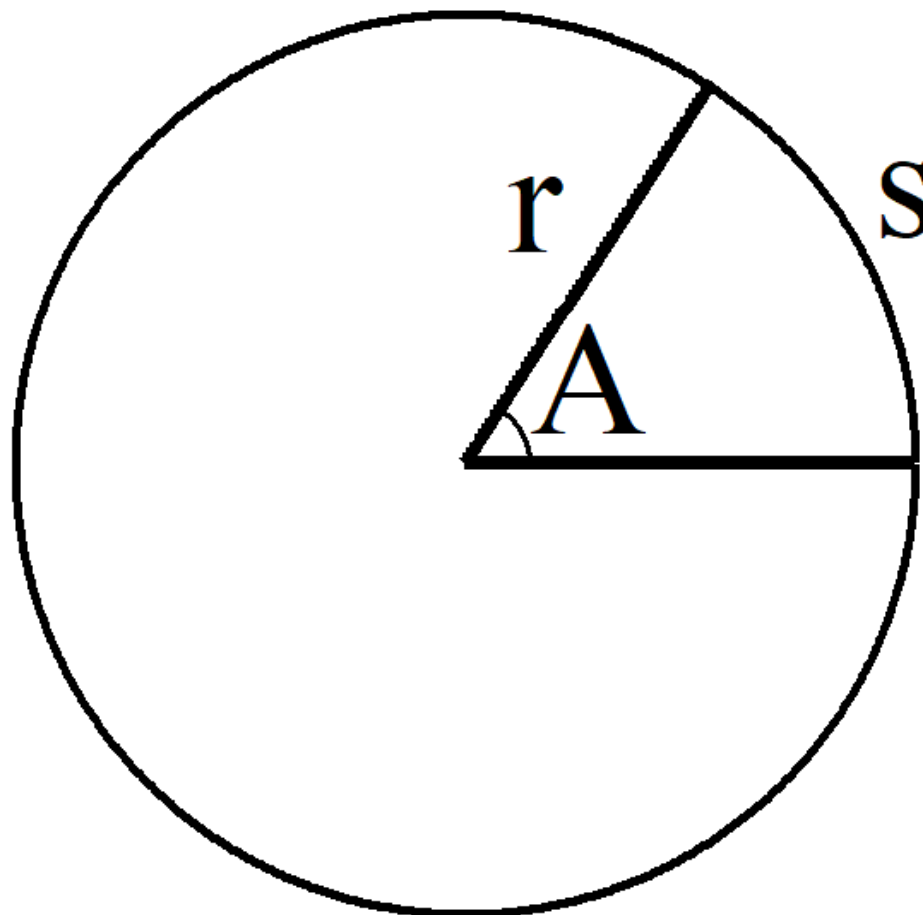
C. $\frac{\ln 2}{0.11}$

D. $\frac{\ln 2}{\ln 1.11}$

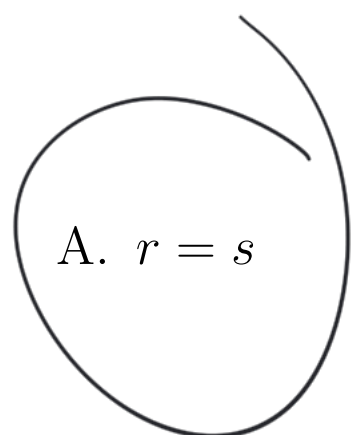
E. $\ln\left(\frac{2}{1.11}\right)$

$$2 = e^{.11t} \rightarrow t = \frac{\ln 2}{.11}$$

8. In the picture below, the measure of angle A is 1 radian. Select the true statement.



$$s = r\theta = r \cdot 1 = r$$



A. $r = s$

B. $\pi r^2 = s^2$

C. $2\pi r = 2s$

D. $\frac{s}{r} = \pi$

E. $rs = \pi$

9. Each of the expressions below simplifies to an integer. Choose the largest one.

Hint: The change of base theorem and properties of logarithms are helpful here.

A. $\frac{\ln(36)}{\ln(6)}$

$\log_6 36 = 2$

B. $\log_{\frac{1}{5}}(5) = -1$

C. $\log_4(16) = 2$

D. $\log_2(4) + \log_2(2)$

$2 + 1 = 3$

E. $\log_3(1) = 0$

10. Severus wants to produce 25 liters of a potion that is 40% alcohol. To make it, he is going to mix x liters of a 20% alcohol potion with y liters of a 70% alcohol potion. Which of the systems below could be solved to determine the amount of each type of potion Severus needs to use?

A. $x + y = 25$
 $x + y = 40$

B. $x + y = 25$
 $0.2x + 0.7y = 25$

C. $x + y = 25$
 $20x + 70y = (0.4)(25)$

D. $x + y = 25$
 $20x + 70y = 40$

E. $x + y = 25$
 $0.2x + 0.7y = (0.4)(25)$

11. A population of mosquitos is released for a study. After 1 week there were 200 mosquitos. After 5 weeks there were 1000 mosquitos. The size of the population t weeks after the release is modeled by $A(t) = Pe^{rt}$. What is the value of r ?

Note: $A(t) = Pe^{rt}$ is equivalent to $A(t) = ae^{bt}$

$(1, 200) \quad (5, 1000)$

A. $\frac{5}{e^6}$

B. $\frac{\ln 5}{4}$

C. $\frac{\ln 5}{5}$

D. $\ln 5$

E. $\frac{5}{e^4}$

① $1000 = Pe^{r(5)}$ ①
 ② $200 = Pe^{r(1)}$ ②

$\frac{1000}{200} = \frac{Pe^{5r}}{Pe^r}$
 $5 = e^{4r}$

$r = \frac{\ln 5}{4}$

12. Suppose that $a > 0$ and $a \neq 1$. Select the statement that is not true for all $x > 0$ and $y > 0$.

A. $a^{\log_a x} = x$

B. If $\log_a x = \log_a y$, then $x = y$.

C. $\log_a(x^y) = y \log_a(x)$

D. If $x = \log_a y$, then $a^y = x$.

E. $\log_a(a^x) = x$

13. Choose the angle that is not complementary, supplementary, or coterminal with the angle $\theta = \frac{\pi}{7}$.

Supp

A. $\frac{6\pi}{7}$

B. $\frac{13\pi}{7}$

Comp

C. $\frac{5\pi}{14}$

coterm

D. $\frac{15\pi}{7}$

coterm

E. $\frac{-13\pi}{7}$

14. Suppose $g(x) = (7a - 10)^x$. For which value of a is $g(x)$ not an exponential function?

$7a - 10 = 1 \rightarrow a = \frac{11}{7}$

A. $\frac{11}{7}$

B. $\frac{12}{7}$

C. 10

D. 12

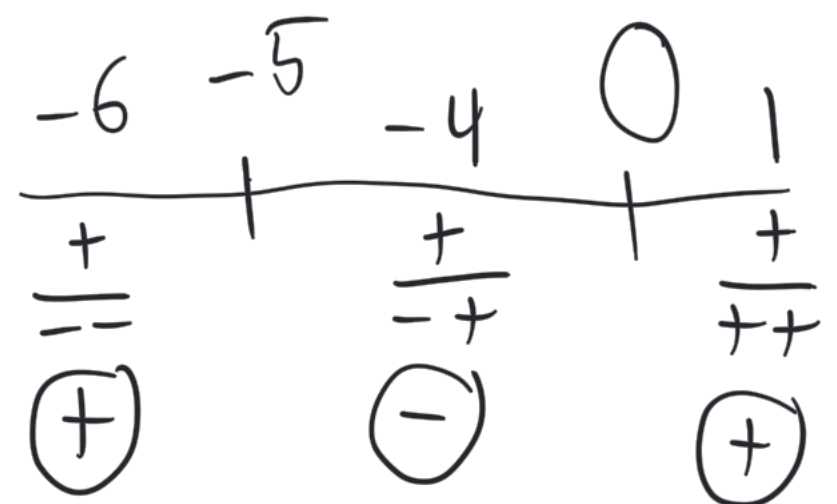
E. 11

15. Find the solution to the inequality:

$\frac{1}{x} - \frac{1}{x+5} > 0$

$\frac{5}{x(x+5)} > 0$

$\frac{1}{x} > \frac{1}{x+5}$



A. $(-5, 0) \cup (0, \infty)$

B. $(-\infty, \infty)$

C. $(\infty, -5) \cup (-5, 0)$

D. $(-5, 0)$

E. $(-\infty, -5) \cup (0, \infty)$

16. Identify the domain of the function $f(x) = \log_5(3 - x) + 4$

$$3 - x > 0 \rightarrow x < 3$$

A. $(-\infty, 3)$

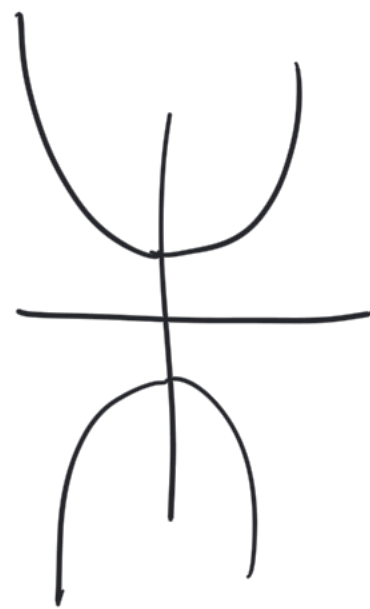
B. $(3, \infty)$

C. $(-3, 3)$

D. $(0, \infty)$

E. $(-\infty, \infty)$

17. Select the system that has no solutions.



A. $y = -x^2 + 1$
 $y = x^2 - 1$

B. $y = -x^2 + 1$
 $xy = 1$

C. $y = x^2 + 1$
 $y = -x^2 - 1$

D. $y = x^2 + 1$
 $xy = -1$

E. $y = x^2$
 $y = -x^2$

18. Evaluate $\log_9(243)$.

$$\log_9(3^5) = 5 \log_9(3) = 5 \cdot \frac{1}{2} = \frac{5}{2}$$

A. $\frac{3}{2}$

B. $\frac{5}{2}$

C. 9

D. $-\frac{1}{9}$

E. 5

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 19–20 are worth 4 points each.

19. Solve the equation:

$$e^{2x} - 21 = 4e^x$$

$$e^{2x} - 4e^x - 21 = 0$$

$$(e^x - 7)(e^x + 3) = 0$$

$$e^x - 7 = 0$$

$$e^x = 7$$

$$x = \ln 7$$

 $x =$ _____

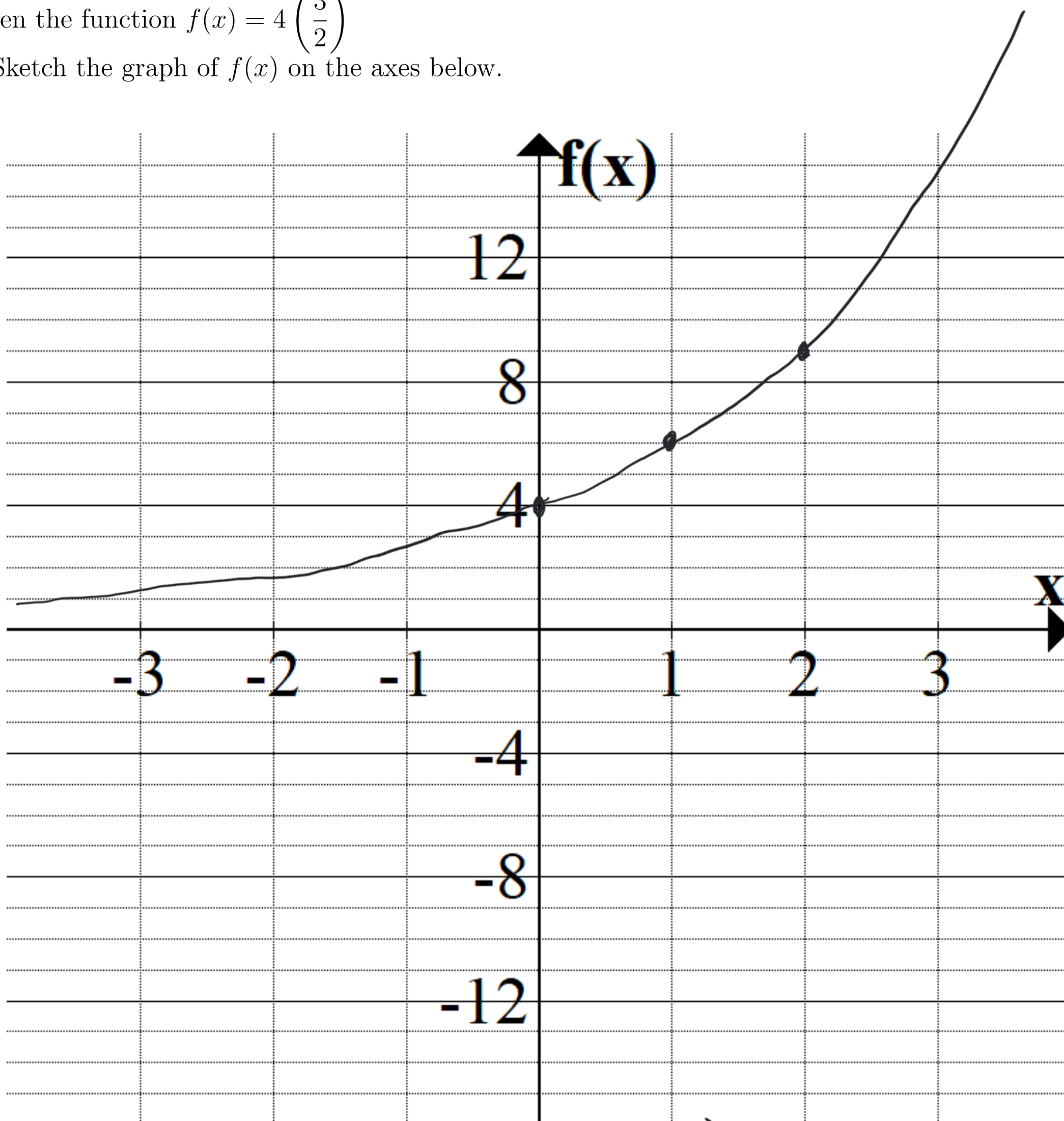
$$e^x + 3 = 0$$

$$e^x = -3$$

 $\emptyset$

TURN OVER FOR THE LAST PROBLEM.

20. Given the function $f(x) = 4\left(\frac{3}{2}\right)^x$
- a) Sketch the graph of $f(x)$ on the axes below.



- b) Identify two points on the graph: $(0, 4)$ $(1, 6)$
- c) State the equations of any asymptotes: $y = 0$
- d) State the domain of $f(x)$ in interval notation: $(-\infty, \infty)$
- e) State the range of $f(x)$ in interval notation: $(0, \infty)$

Turn in your scantron and your free response to your TA. The worked-out solutions will be posted on Canvas after the test.