INSTRUCTIONS: **Simplify** and **box** all your answers. Write neatly and **show all work**. A correct answer with incorrect or no supporting work may receive no credit. Books, notes, electronic devices (such as calculator or other unauthorized electronic resources) are not permitted. **Give all answers in exact form.**

Potentially useful formulas:

$$A = \frac{1}{2}r^2\theta$$

$$S = r\theta$$

NOTE: YOU MAY TEAR OFF THIS FIRST PAGE AND USE (FRONT AND BACK) AS SCRATCH PAPER.

i. DO NOT START UNTIL INSTRUCTED BY A PROCTOR.

ii. THE EXAM IS ON BOTH SIDES OF EACH FOLLOWING EXAM PAGE

iii. WRITE YOUR NAME ON THE NEXT PAGE. JUST BEFORE YOU UPLOAD TO GRADESCOPE WRITE DOWN YOUR UPLOAD TIME ON THE NEXT PAGE.

iv. WHEN YOU FINISH (IF BEFORE THE EXAM END TIME) PLEASE QUIETLY COLLECT YOUR THINGS AND LINE UP AT THE BACK OF THE ROOM. A PROCTOR WILL INDICATE WHEN IT'S YOUR TURN TO EXIT THE ROOM AND UPLOAD TO GRADESCOPE.

Name: _____

1. Find the slant asymptote the following rational function: (5 pts)

$$r(x) = \frac{4x^3 + 16x^2 + 12x}{2x^2 - 6x}$$

2. For $R(x) = \dfrac{3x^2 - 3x - 18}{x^2 - 2x - 3}$ (8 pts)

(a) Find the (x-coordinate(s)) of any hole(s). If there are none state NONE.

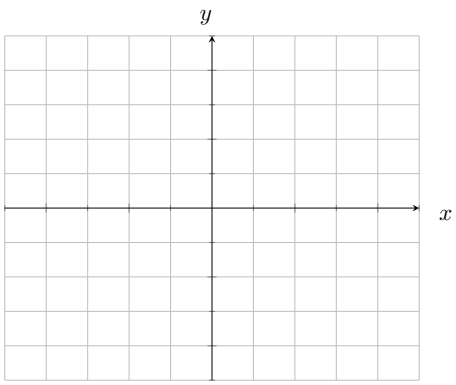
(b) Find the (y-coordinate(s)) of any hole(s). If there are none state NONE.

(c) Determine the end behavior of $R(x)$.

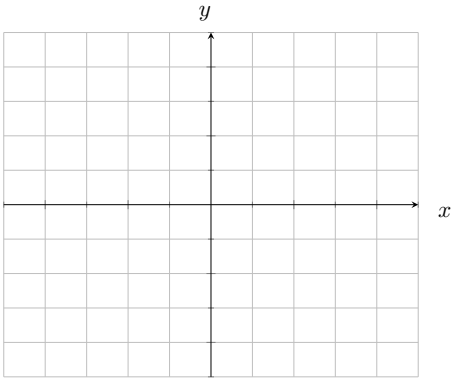
(d) Find any vertical asymptote(s). If there are none state NONE.

3. Sketch the following graphs: Be sure to label any asymptotes and intercepts for each graph. (10 pts)

(a) $f(x) = -\log_8(x)$



(b) $g(x) = 2^x + 1$



(c) For $f(x)$ given in part (a) find $f\left(8^{2x}\right)$.

4. The following are unrelated.

(a) Simplify (rewrite without logs): $5\log(1) - e^{3\ln(t)} + \log_4(64) + \log_3(30) - \log_3(10)$ (4 pts)

(b) Rewrite as a single logarithm without negative exponents (as usual, simplify your final answer): $-4\log_3(x) + \log_3(y) + 3\log_3(\sqrt{x})$ (5 pts)

5. Solve the following equations for x. If there are no solutions write "no solutions" (as usual, be sure to justify answer for full credit). (16 pts)

(a) $\log_x(27) = 3$

(b) $\ln(4) - \ln(x+1) = \ln(3)$

(c) $3^{x+1} = 9^{x-1}$

(d) $7 + 4x = xe^2 - 3$

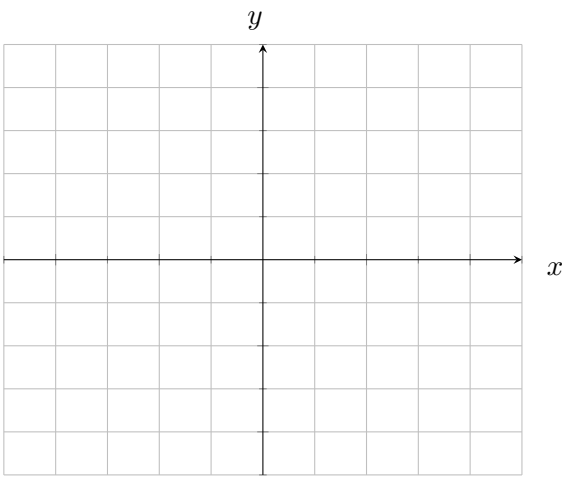
6. The velocity of a sky diver t seconds after jumping is modeled by $v(t) = 50\left(1 - e^{-0.2t}\right)$.

   (a) After how many seconds is the velocity 5 ft/s? (Give your answer as an exact value, do not attempt to approximate). (4 pts)

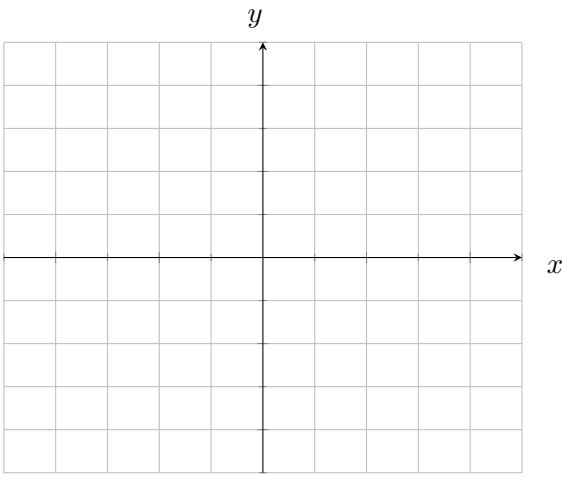
   (b) After a very long time, the velocity reaches an approximately constant value, known as the terminal velocity. What is the terminal velocity of the sky diver ? (3 pts)

7. Sketch each angle in standard position on the unit circle.

   (a) $\dfrac{4\pi}{3}$ (2 pts)



   (b) $-\dfrac{3\pi}{4}$ (2 pts)



8. The point $(-3, -2)$ is on the terminal side of an angle, θ, in standard position. Determine the exact values of the following.

   (a) $\sin\theta$ (3 pts)

   (b) $\csc\theta$ (2 pts)

   (c) $\tan\theta$ (2 pts)

9. My friend and I are watching a football game at my place, and ordering pizza. I want to order a 10 inch diameter circular pizza, but my friend thinks ordering two 7 inch diameter circular pizzas will give us more food (in terms of surface area of pizza). Is my friend correct? Please show work to get points for this question, just a "yes" or a "no" won't suffice. (4 pts)

10. Simplify the following:

    (a) $\cos(30^\circ) + 2\sin^2(30^\circ)$ (4 pts)

    (b) For a particular angle θ in standard position suppose we know $\tan\theta < 0$ and $\cos\theta > 0$. What quadrant is θ in? You do not need to justify your answer. (3 pts)

11. Find the following. If a value does not exist write DNE. (18 pts)

(a) $\sin\left(\frac{2\pi}{3}\right)$

(b) $\cos\left(\frac{\pi}{2}\right)$

(c) $\cot(0^\circ)$

(d) $\csc\left(\frac{7\pi}{6}\right)$

(e) $\tan(-45^\circ)$

(f) $\sec\left(\frac{\pi}{6}\right)$

EXAM CONTINUES ON BACK

12. Last night, I was standing near the base of Flagstaff mountain in a flat field. The peak of the mountain is 1550 ft above the field. I took out my laser pointer, and pointed it at the top of the mountain. If the angle of elevation of the laser beam is 60°, how far does the laser beam travel to reach the top of the mountain? (5 pts)