

Directions: Show all work algebraically unless otherwise indicated. If solving graphically, label the graph and the solution on the graph. If rounding is necessary, round to the nearest thousandth.
20 points [Chapters 5 and 6 sections 1-4.]

$$y = \frac{(x-4)(x+4)}{(x+9)(x-6)}$$

1. For the rational function $y = \frac{x^2 - 16}{x^2 + 3x - 54}$ find the following, show your work:

see back
2pts

a. Domain All real #s except $x = -9$ and $x = 6$

6pts (-34 only center part no axis labels)
g. Graph, including the information in a-e; plot additional points as needed.

b. vertical asymptote(s) $x = -9, x = 6$

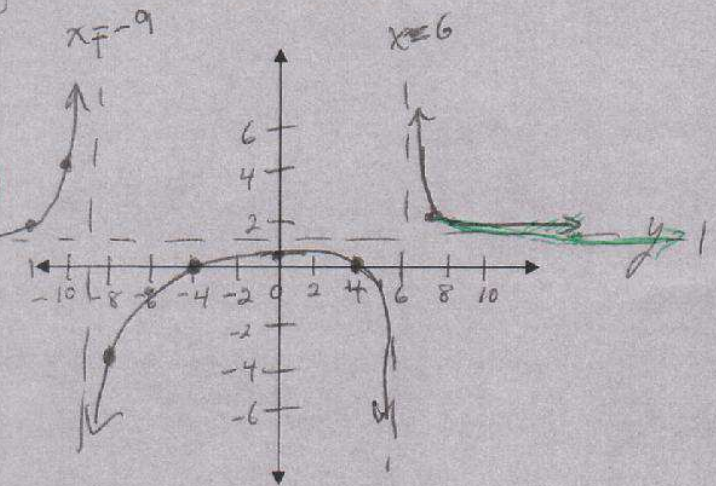
c. end behavior (horizontal asymptote) $y = 1$

d. y-intercept $y = 0 \Rightarrow \frac{0^2 - 16}{0^2 + 3(0) - 54} = \frac{-16}{-54} = 0.296$

e. x-intercept(s) $y = 0 \Rightarrow 0 = x^2 - 16 \Rightarrow 0 = (x+4)(x-4) \Rightarrow x = -4, 4$

f. symmetry? None (neither y-axis nor origin)

h. Is this function one-to-one? No Why or why not? Two different x-values give the same y-value. Does not pass the horizontal line test.



2. Find the following for the rational functions below:

a. The x and y coordinates of the hole in the graph of $y = \frac{3x^2 - 12}{x^2 - x - 2} = \frac{3(x^2 - 4)}{(x-2)(x+1)} = \frac{3(x+2)(x-2)}{(x+1)(x-2)}$
 Hole at $(2, 4)$ or $(2, \frac{12}{3})$. $x = 2$ in simplify $\frac{3(4) - 12}{3} = \frac{12}{3}$
 $x = -1$ is asymptote

b. The horizontal asymptote of $f(x) = \frac{4x - 3}{x^2 + 5}$ is $y = 0$

3. Solve the inequality: $5x^3 + 10x^2 \leq 15x$. Draw your solution on a number line and write it in interval notation.

$$5x^3 + 10x^2 - 15x \leq 0$$

$$5x(x^2 + 2x - 3) \leq 0$$

$$5x(x+3)(x-1) \leq 0$$

$$x = 0, x = -3, x = 1$$



10 points

4. For $f(x) = \frac{7}{x+6}$ and $g(x) = x^2 - 9$ find the following:

- 1 pt a. Domain of f all real #s except $x = -6$ 2 pts
- 1 pt b. Domain of g all real #s 3 pts
- d. Domain of $f \circ g$ all real #s except $x = \pm\sqrt{3}$
- e. $f \circ g(5)$ (simplify completely)

3 pts c. $f \circ g(x)$ (simplify completely)

$$f(g(x)) = \frac{7}{(x^2-9)+6} = \frac{7}{x^2-3}$$

$$f(g(5)) = \frac{7}{5^2-3} = \frac{7}{22} \approx 0.318$$

or $g(5) = 5^2 - 9 = 25 - 9 = 16$

$$f(16) = \frac{7}{16+6} = \frac{7}{22}$$

5 points

5. If $(f \circ g)(x) = (3x-4)^5$, find $f(x)$ and $g(x)$. Then $f(x) = x^5$ and $g(x) = (3x-4)$

20 points

6. Graph $f(x) = 3^{(x+2)}$; using a table of values, list at least four points. 2 pts

2 pts Domain of $f(x)$: all real #s

2 pts Range of $f(x)$: all real # > 0

2 pts Asymptote: $y = 0$

x	f(x)	x	f ⁻¹ (x)
0	3 ² = 9	9	0
-1	3 ¹ = 3	3	-1
-2	3 ⁰ = 1	1	-2
-3	3 ⁻¹ = 1/3	1/3	-3
-4	3 ⁻² = 1/9	1/9	-4

Graph $f^{-1}(x)$ on the same axis, using a table of values, include at least four points and any asymptotes.

Determine the equation of $f^{-1}(x)$ $f^{-1}(x) = -2 + \log_3 x$ (Show your work below.)

Original function $y = 3^{(x+2)}$

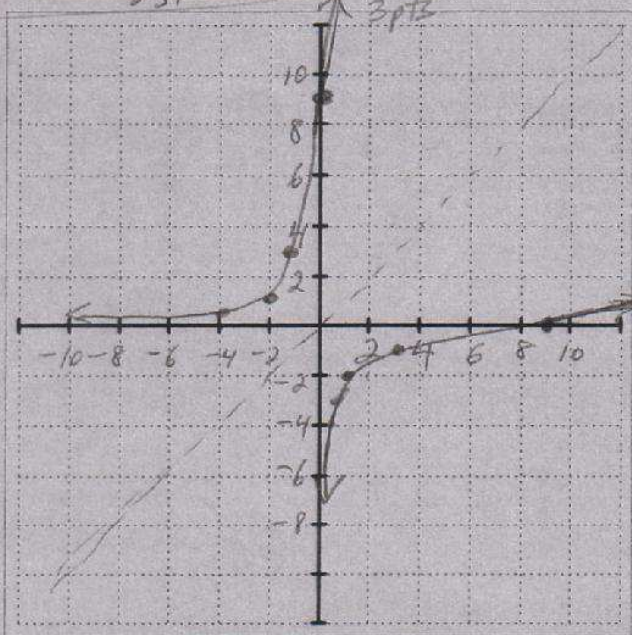
Switch x + y

$$x = 3^{(y+2)}$$

Solve for y

$$(y+2) = \log_3 x$$

$$y = -2 + \log_3 x$$



$x=0$

9 points (3 each)

7. Evaluate the following by rewriting in exponential form and simplifying. Show your work:

a. $\log_4(64) = x$

$$4^x = 64$$

$$4^x = 4^3$$

$$x = 3$$

b. $\log_5(1) = x$

$$5^x = 1$$

$$5^x = 5^0$$

$$x = 0$$

c. $\log_5\left(\frac{1}{125}\right) = x$

$$5^x = \frac{1}{125}$$

$$5^x = 5^{-3}$$

$$x = -3$$

16 points (4 each)

8. Solve for x . Give exact answers and where appropriate, approximate answers rounded to 3 decimal places.

a. $9^{4x-7} = 27^x$

$$3^{2(4x-7)} = (3^3)^x$$

$$3^{8x-14} = 3^{3x}$$

$$8x - 14 = 3x$$

$$5x = 14$$

$$x = \frac{14}{5} = 2\frac{4}{5} = 2.8$$

b. $4^{3x-5} = \frac{1}{8}$

$$2^{2(3x-5)} = 2^{-3}$$

$$6x - 10 = -3$$

$$6x = 7$$

$$x = \frac{7}{6} = 1.167$$

c. $e^{3x} = 10$

$$\log_e 10 = 3x$$

$$\text{or } \ln 10 = 3x$$

$$x = \frac{\ln 10}{3} \approx \frac{2.302585}{3}$$

$$\approx 0.768$$

d. $\log_2(3x-4) = 5$

$$3x - 4 = 2^5$$

$$3x - 4 = 32$$

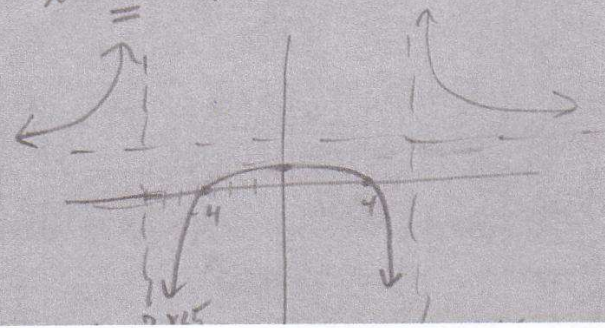
$$3x = 36$$

$$x = 12$$

section 111-011 I forgot to tell them about typo in #1,
thus there graph will be different.

$y = \frac{x^2 - 16}{x^2 + x - 54}$ this make den. not factorable.

window
 $x = -15$
 $x = 15$



$$x^2 + x - 54 = 0$$

$$x = \frac{-1 \pm \sqrt{1 - 4(1)(-54)}}{2(1)}$$

$$x = \frac{-1 \pm \sqrt{217}}{2}$$

$$x \approx \frac{-1 \pm 14.731}{2}$$

$$x \approx -7.865 \quad (\text{ok if } x = -6)$$

$$x \approx 6.865$$