Exam #3

(6) (b) Write as a single logarithm. Simplify as much as possible. (4 points)

$$4\ln(3x) + \ln(5y) - 3\ln(6x)$$

$$\underbrace{\ln(3x)^4 + \ln(5y)} - \ln(6x)^3$$

$$\ln\left((3x)^4\cdot(5y)\right) - \ln(6x)^3$$

$$\ln\left(\frac{(3x)^4(5y)}{(6x)^3}\right)$$

$$\ln\left(\frac{3^4x^4\cdot 5y}{6^3x^3}\right)$$

$$\ln\left(\frac{\cancel{3}\cdot\cancel{3}\cdot\cancel{3}\cdot 3\cdot \cancel{x^4}\cdot 5\cdot y}{2\,\cancel{6}\cdot\cancel{6}\cdot\cancel{6}\;\cancel{x^3}}\right)$$

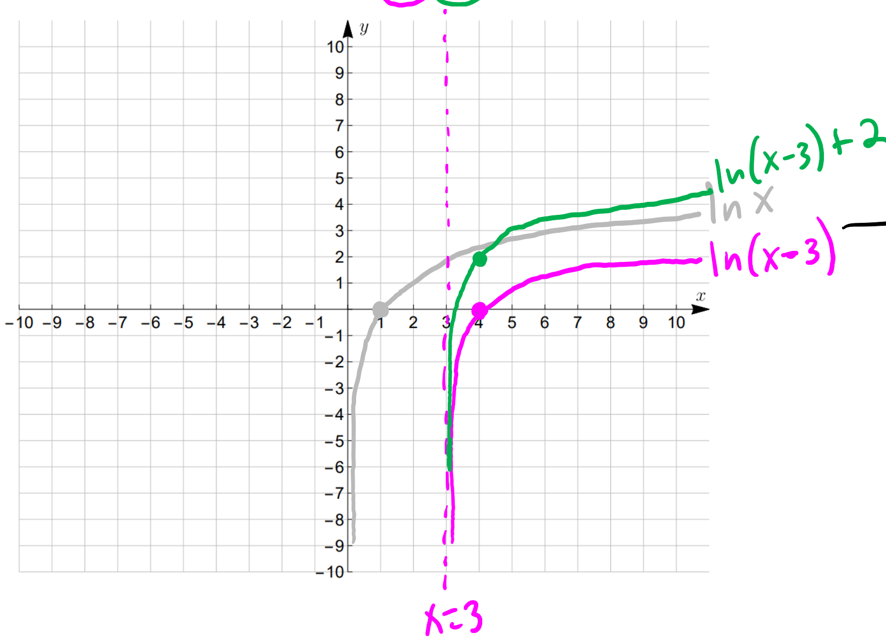
2 2

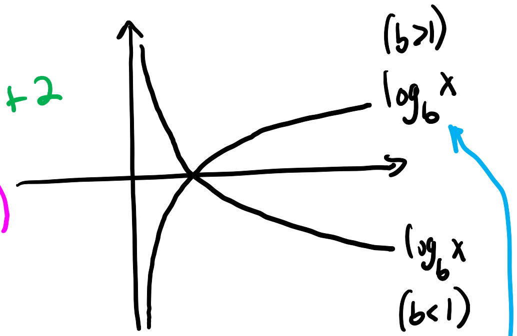
$$\ln\left(\frac{15xy}{8}\right)$$

5. Use transformations of the graph of $f(x) = \ln x$ to graph the given function. (6 points)

1st right 3

$f(x) = \ln(x - 3) + 2$ up 2





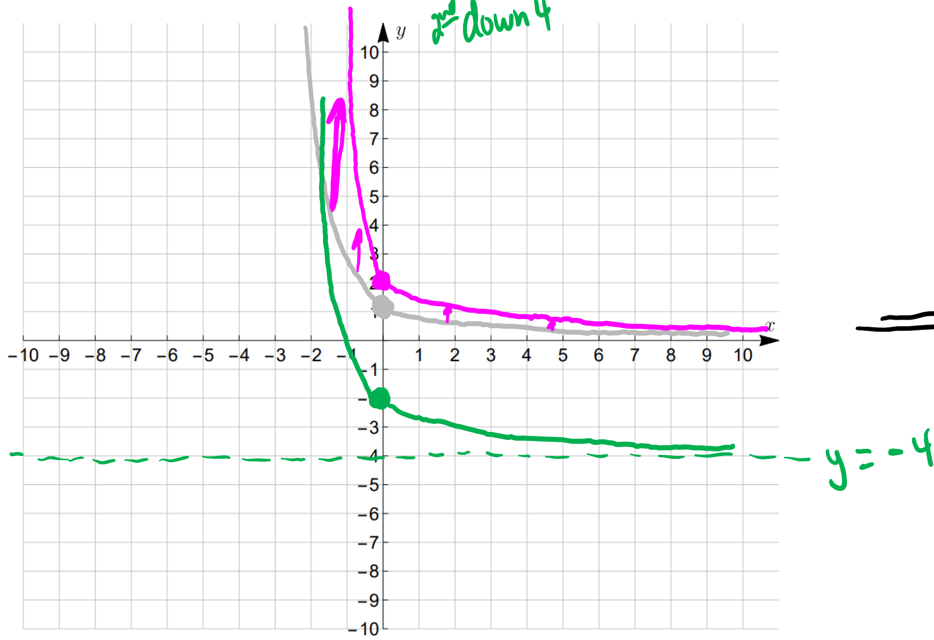
$\ln = \log_e$

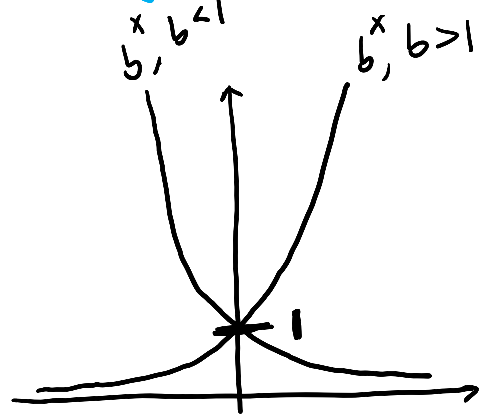
2.71828... >1

2. Use transformations of the graph of $f(x) = \left(\frac{1}{3}\right)^x$ to graph the given function. (6 points)

1st vertical stretch $\quad$ <1

$$f(x) = 2\left(\frac{1}{3}\right)^x \underbrace{- 4}_{\text{2nd down 4}}$$





Exam #2

$3x^2-2$ $\quad$ $3x^2-2$

11. For $\underline{f(x) = 3x^2 - 2}$ and $g(\cancel{x}) = 4\cancel{x} + 1$, find the following functions. (4 points each)

(a) $(f \circ g)(2)$

(b) $(g \circ f)(x)$

b) $(g \circ f)(x) = g(f(x)) = g(3x^2-2)$

used to be x

$= 4(3x^2-2)+1$

$= 12x^2-8+1$

$= 12x^2-7$

a) $(f \circ g)(2) = f(g(2))$

$g(\cancel{x}) = 4x+1$
$\quad$ 2

$f(\cancel{x}) = 3\cancel{x}^2-2$
$\quad$ 4x+1 $\quad$ 4x+1

$$(f \circ g)(x) = f(g(x)) = f(4x+1)$$

$$= 3\underbrace{(4x+1)}^2 - 2$$

$$(4x+1)(4x+1) = 16x^2 + 4x + 4x + 1 = 16x^2 + 8x + 1$$

$$= 3(16x^2 + 8x + 1) - 2$$

$$= 48x^2 + 24x + 3 - 2$$

$$= 48x^2 + 24x + 1$$

$$(f \circ g)(\overset{2}{\cancel{x}}) = 48\overset{2}{\cancel{x}}^2 + 24\overset{2}{\cancel{x}} + 1$$

$$= 48(4) + 24(2) + 1$$

$$= 241$$

$$g(\overset{2}{\cancel{x}}) = 4\overset{2}{\cancel{x}} + 1$$

$$f(\overset{9}{\cancel{x}}) = 3\overset{9}{\cancel{x}}^2 - 2$$

$$(f \circ g)(2) = f(g(2))$$

$$g(2) = 4 \cdot 2 + 1 = 8 + 1 = 9$$

$$= f(9) = 3(9)^2 - 2 = 3(81) - 2 = 241$$

$$\begin{cases} x + 2y - 3z = 9 & (1) \\ 2x - 2y + 2z = -8 & (2) \\ -x + 3y - 4z = 15. & (3) \end{cases}$$

(1) + 2×(2)

$$\begin{array}{r} x + \cancel{2y} - 3z = 9 \\ + \quad 4x - \cancel{2y} + 4z = -16 \\ \hline 5x \quad + z = -7 \end{array}$$

(3) + 3 (2)

$$\begin{array}{r} -x + \cancel{3y} - 4z = 15 \\ + \quad 6x - \cancel{3y} + 6z = -24 \\ \hline 5x \quad + 2z = -9 \end{array}$$

(4) $(5x + z = -7)^{\times(-1)} \longrightarrow -5x - z = 7$

(5) $5x + 2z = -9 \longrightarrow 5x + 2z = -9$

$$\begin{array}{r} -\cancel{5x} - z = 7 \\ \cancel{5x} + 2z = -9 \\ \hline z = -2 \end{array}$$

(4)

$$\begin{array}{r} 5x - \cancel{2} = -7 \\ +\cancel{2} \quad +2 \\ \hline \frac{\cancel{5}x}{\cancel{5}} = \frac{-5}{5} \end{array}$$

$x = -1$

(2) $2(-1) - y + 2(-2) = -8$

$-2 - y - 4 = -8$

$\cancel{-6} - y = -8$

$\cancel{+6} \qquad +6$

$$\frac{\cancel{+}y}{\cancel{+1}} = \frac{-2}{-1}$$

$$y = 2$$

12. The function $f(x) = \sqrt{2x+4} - 5$ is one-to-one. Find an equation for $f^{-1}(x)$. (5 points)

$$y\ \cancel{f(x)} = \sqrt{2x+4} - 5$$

$$x = \sqrt{2y+4} - \cancel{5}$$
$$+5 \qquad \cancel{+5}$$

$$(x+5)^2 = \cancel{\sqrt{2y+4}}^{\cancel{2}}$$

$$(x+5)(x+5) = x^2+5x+5x+25$$
$$= x^2+10x+25$$

$$x^2+10x+25 = 2y+\cancel{4}$$
$$-4 \qquad \cancel{-4}$$

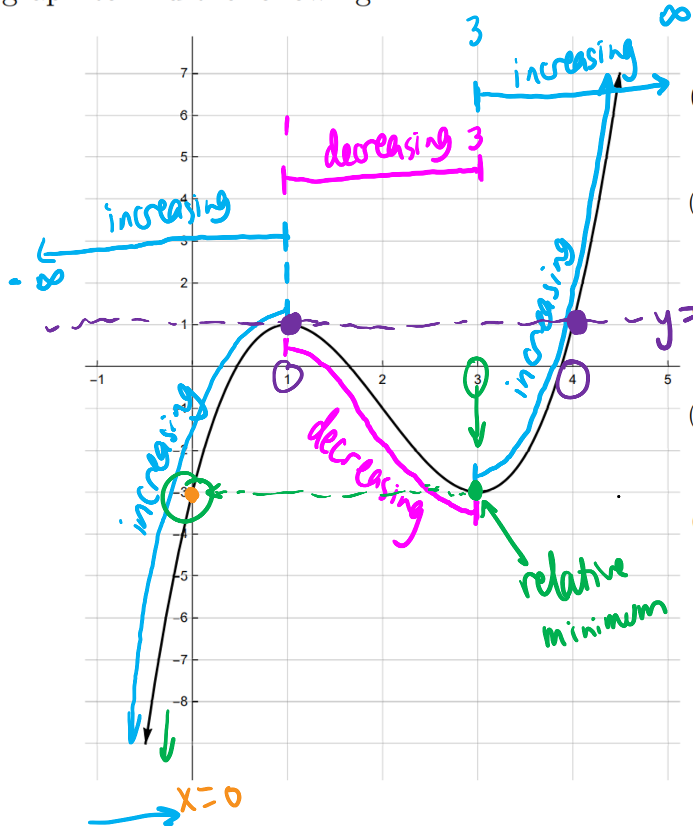
$$\frac{x^2+10x+21}{2} = \frac{\cancel{2}y}{\cancel{2}}$$

$$y = \frac{x^2+10x+21}{2}$$

Mistake: $x^2+5^2 = \cancel{\sqrt{2y+4}}^{\cancel{2}}$

x^2+25

5. Use the graph to find the following.



(a) The intervals on which f is increasing. (3 points)

$(-\infty, 1) \cup (3, \infty)$

(b) The intervals on which f is decreasing. (3 points)

$(1, 3)$

(c) The number at which f has a relative minimum. (2 points)

$x = 3$

(d) The relative mimimum of f. (2 points)

$y = -3$

(e) $f(0)$ (2 points)

$x=0$

$y = -3$

(f) The values of x for which $f(x) = 1$. (2 points)

left right y

$x = 1, x = 4$

smallest largest

The left-most value of x for which $f(x)=1$

$x = 1$

(c) Solve the following equation. Provide the exact value. (4 points)

$3x - \cancel{5} > 0$

$+\cancel{5} \quad +5$

$\frac{\cancel{3}x}{\cancel{3}} > \frac{5}{3}$

$x > \frac{5}{3} \approx 1.67$

$$\frac{\cancel{4}\log_4(3x-5)}{\cancel{4}} = \frac{8}{4}$$

$$\log_4(3x-5) = 2$$

$$\cancel{4}^{\cancel{\log_4}(3x-5)} = 4^2$$

$$3x - \cancel{5} = 16$$

$$+\cancel{5} \quad +5$$

$$\frac{\cancel{3}x}{\cancel{3}} = \frac{21}{3}$$

$$x = 7$$

bigger than $\frac{5}{3}$

$x + \cancel{5} = 7$

$-\cancel{5} \quad -5$

$x - \cancel{5} = 7$

$+\cancel{5}$

8. The number of milligrams of a medication in a patient's body is decreasing exponentially $\left(A = A_0 e^{kt}\right)$. The patient is given 50 milligrams of the medication and after 6 hours, the patient still has 17 milligrams left in their body. It's not safe for the patient to take more medication until there is less than 5 milligrams of medication left in their body. What is the minimum amount of time after the patient's first dose of the medication they have to wait before they can safely take their next dose of the medication? Round your answer to the nearest hour. (6 points)

$$A = A_0 e^{kt}$$

$$\frac{17}{50} = \frac{\cancel{50} e^{k(6)}}{\cancel{50}}$$

$$\cancel{\log_e} \cancel{e}^{D}$$

$$\frac{17}{50} = e^{6k}$$

$$\cancel{\ln} \cancel{e}^{D}$$

$$\ln \frac{17}{50} = \cancel{\ln e}^{6k}$$

$$\frac{\ln \frac{17}{50}}{6} = \frac{\cancel{6}k}{\cancel{6}}$$

$$\boxed{\ln}\ \left(\ \boxed{1}\boxed{7}\boxed{\div}\boxed{5}\boxed{0}\boxed{)}\boxed{\div}\boxed{6}\right.$$

automatic

$$k = \frac{\ln \frac{17}{50}}{6} = -0.1798 \text{ more}$$

$$A = A_0 e^{-0.1798t}$$

A_0 time $= 0 \rightarrow$ initial starting

$$\frac{5}{50} = \frac{\cancel{50} e^{-0.1798t}}{\cancel{50}}$$

$$.1 = e^{-0.1798t}$$

$$\ln .1 = \cancel{\ln e}^{-0.1798t}$$

round

$$\frac{\ln .1}{-0.1798} = \frac{-0.\cancel{1798}t}{-0.\cancel{1798}} \Rightarrow t = 12.8 \rightarrow 13 \text{ hours}$$

Homework: Section 4.1 HW

Score: 0 of 1 pt ◀ 11 of 13 (0 complete) ▼ ▶

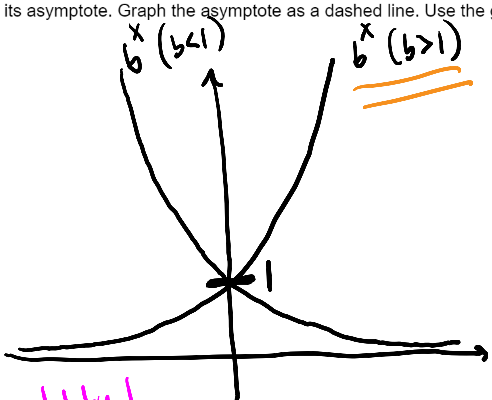
4.1.39

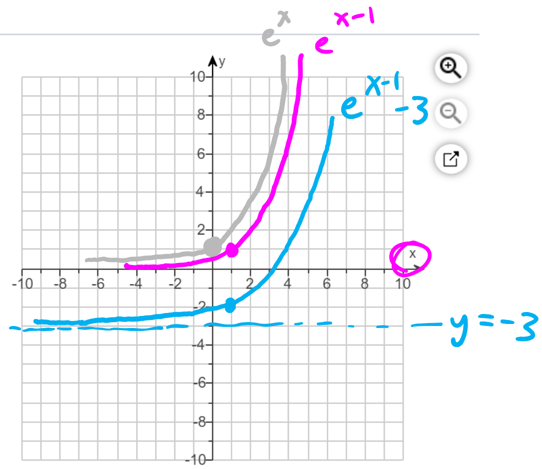
Use transformations of the graph of $f(x) = e^x$ to graph the given function. Be sure to give the equation of the asymptote. Use the graphs to determine each function's domain and range. If applicable, use a graphing utility to confirm the hand-drawn graphs.

$h(x) = e^{x-1} - 3$ $e \approx 2.71828...$

Graph $h(x) = e^{x-1} - 3$ and its asymptote. Graph the asymptote as a dashed line. Use the graphing tool to graph the function.

Click to enlarge graph Misc





1^{st}: right by 1

$$h(x) = e^{x-1} - 3$$

2^{nd} down 3

Homework: Section 4.3 HW

Score: 0 of 1 pt ◀ 10 of 18 (0 complete) ▼ ▶

4.3.25

Use properties of logarithms to expand the logarithmic expression as much as possible. Evaluate logarithmic expressions without using a

$$\log_4\left(\frac{16}{\sqrt{x+8}}\right) = \underbrace{\log_4 16}_{4^{?}=16} - \log_4 \underbrace{\sqrt{x+8}}_{(x+8)^{\frac{1}{2}}}$$

$$\log_4\left(\frac{16}{\sqrt{x+8}}\right) = \square$$

$$2 - \frac{1}{2}\log_4(x+8)$$

$$a^{\frac{m}{n}} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$$

$$x^{\frac{1}{2}} = \sqrt[2]{x^1}$$

3. Without graphing, determine whether the function is even, odd or neither. Then determine whether the function's graph is symmetric with respect to the x-axis, y-axis, the origin, or none of these. **Explain your answer!** (4 points)

$$\cancel{x^2} + y = -3$$

even: $f(-x) = f(x)$

odd: $f(-x) = -f(x)$

$-\cancel{x^2} \qquad -x^2$

$y = -x^2 - 3$ $\qquad f(3)$

$f(x) = -x^2 - 3$ ← original

$f(-x) = -\underbrace{(-x)^2}_{x^2} - 3$

$= -x^2 - 3$

$= f(x)$

$f(-x) = f(x)$ even function

⇓

symmetric about the y-axis