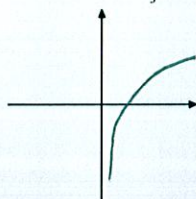


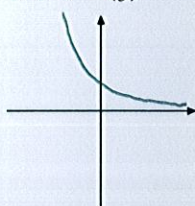
Sketch the general shape and position of the following graphs.
You do NOT need to plot specific points.

(3½) EACH - MUST HAVE CORRECT ASYMPTOTE SCORE: / 14 PTS

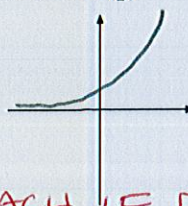
$$f(x) = \log_{\frac{1}{3}} x$$



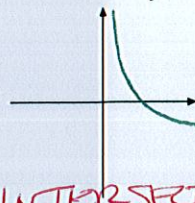
$$f(x) = \left(\frac{2}{3}\right)^x$$



$$f(x) = \left(\frac{7}{2}\right)^x$$



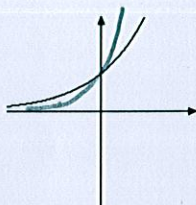
$$f(x) = \log_{\frac{1}{3}} x$$



(-1½) EACH IF DOESN'T INTERSECT AXIS

The graph of $f(x) = 3^x$ is shown below. On the same grid, sketch the graph of $g(x) = 5^x$.

SCORE: / 7 PTS



(7)

Fill in the blanks. Write DNE if the value is undefined.

(3½) EACH

SCORE: / 35 PTS

$$\log(-1,000) = \text{DNE}$$

$$\log_2 32 = 5$$

$$\log_8 8^0 = 0$$

$$\ln e^{-7} = -7$$

$$\log_{10,000} 1 = -4$$

$$\log_8 \frac{1}{2} = -\frac{1}{3}$$

$$e^{\ln 0} = \text{DNE}$$

$$\log_6 0 = \text{DNE}$$

$$\log_{49} 7 = \frac{1}{2}$$

$$\ln 1 = 0$$

Write $2\ln(y+1) - 3\ln(y+2) - \ln(y^2+4)$ as a single logarithm.

SCORE: / 7 PTS

ANSWER: $\ln \frac{(y+1)^2}{(y+2)^3 (y^2+4)}$

(7)

(-2) EACH ERROR

Write $\log\left(\frac{x^4}{y^5 \sqrt{z^3+1}}\right)$ as a sum, difference and/or constant multiple of logarithms of the simplest possible quantities.

SCORE: / 7 PTS

ANSWER: $4\log x - 5\log y - \frac{1}{2}\log(z^3+1)$

(7)

(-2) EACH ERROR

Simplify $3\log_6 2 - \log_6 24 + 2\log_6 3 - \log_6 18$.

SCORE: / 7 PTS

$$\begin{aligned} & \log_6 \frac{2^3 \cdot 3^2}{24 \cdot 18} \quad (3) \\ & = \log_6 \frac{1}{6} \quad (2) \\ & = -1 \end{aligned}$$

ANSWER:

$$\frac{-1}{2}$$

Solve $\log_6(3-x) + \log_6(8-x) = 2$.

SCORE: / 14 PTS

$$\log_6((3-x)(8-x)) = 2$$

$$(5) \quad 24 - 11x + x^2 = 6^2 = 36 \quad (4)$$

$$x^2 - 11x - 12 = 0$$

$$(x-12)(x+1) = 0$$

$$x = 12, -1 \quad (2)$$

CHECK:

$$(1/2) \quad x = 12 : \log_6(-9)$$

$$\begin{aligned} & x = -1 : \log_6 4 + \log_6 9 \\ & = \log_6 36 \\ & = 2 \end{aligned}$$

(2) MUST BE THE ONLY ANSWER

ANSWER:

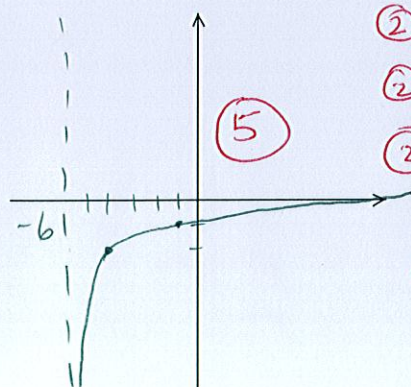
$$\frac{-1}{2}$$

Sketch the graph of $f(x) = \log_3(\frac{1}{2}x + 3) - 2$ using transformations as shown in lecture.

SCORE: / 21 PTS

List all transformations in the correct order, and show the transformation of each significant feature as shown in lecture.

Sketch the graph, showing all the transformed features you found.



(2) (1) LEFT 3

(2) (2) HORIZONTAL STRETCH BY 2

(2) (3) DOWN 2

OR (1*) H. STRETCH BY 2

(2*) LEFT 6

(3) DOWN 2

$$(1) (1, 0) \rightarrow (-2, 0) \rightarrow (-4, 0) \rightarrow (-4, -2) \quad (2\frac{1}{2})$$

$$(1) (\frac{5}{2}, 1) \rightarrow (-\frac{1}{2}, 1) \rightarrow (-1, 1) \rightarrow (-1, -1) \quad (2\frac{1}{2})$$

$$(1) x = 0 \rightarrow x = -3 \rightarrow x = -6 \rightarrow x = -6 \quad (2)$$

You deposit \$12,318 into an account with a 2.71% annual interest rate compounded monthly.

SCORE: / 14 PTS

How long does it take your account to grow to \$16,947, assuming there is no other activity in your account other than the interest payments?

Specify the units of your final answer.

$$(5) \quad 16947 = 12318 \left(1 + \frac{0.0271}{12}\right)^{12t}$$

$$(1) \quad \frac{16947}{12318} = \left(1 + \frac{0.0271}{12}\right)^{12t}$$

$$(3) \quad \ln \frac{16947}{12318} = 12t \ln \left(1 + \frac{0.0271}{12}\right)$$

$$(2) \quad t = \frac{\ln \frac{16947}{12318}}{12 \ln \left(1 + \frac{0.0271}{12}\right)}$$

EXACT ANSWER: _____

DECIMAL APPROXIMATION TO 4 PLACES:

11.7856 YEARS

(2)

(1)

The population of a city is $P(t) = \frac{2954}{1 + 34e^{-0.48t}}$ thousand people, where t is the number of years

SCORE: / 14 PTS

since Jan 1, 2001. At what value of t does the population reach two million people?

Specify the units of your final answer.

$$(2) \quad \frac{2954}{1 + 34e^{-0.48t}} = 2000$$

$$(2) \quad 2954 = 2000(1 + 34e^{-0.48t})$$

$$(2) \quad \frac{2954}{2000} = 1 + 34e^{-0.48t}$$

$$(1) \quad \frac{954}{2000} = 34e^{-0.48t}$$

$$(1) \quad \frac{954}{68000} = e^{-0.48t}$$

$$(2) \quad \ln \frac{954}{68000} = -0.48t$$

EXACT ANSWER: _____

DECIMAL APPROXIMATION TO 4 PLACES:

8.8887 YEARS

(2)

(1)

$$(1) \quad t = -\frac{1}{0.48} \ln \frac{954}{68000}$$