

Exam #2, Chapters 4, 5, 6

Q1) Answer the following for $f(x) = \frac{-5x^4 - 3x^3 + x^2 - 10}{27x^3 + 54x^2 + 36x + 8}$

a) What is the domain?

b) What are (or is) the vertical asymptote(s)?

c) What is the slant asymptote?

d) What is $\lim_{x \rightarrow \infty} f(x)$? What is $\lim_{x \rightarrow -\infty} f(x)$?

Q2) Graph the function $y = \frac{x^3 - 8}{x^2 - 4}$.

Show your table of signs. Label the coordinates of any holes.

Q3) Graph $f(x) = \frac{9}{x-9}$ using the multi-step procedure presented in class.

Q4) Graph $f(x) = \frac{x^2 - 4}{x^2 - 4x}$ using the multi-step procedure presented in class.

Q5) The concentration C (in mg/dl) of a certain antibiotic in a patient's bloodstream is given by $\frac{50t}{t^2 + 25}$ where "t" is the time in hours after taking the antibiotic.

(a) What is the concentration four hours after taking the antibiotic?

(b) In order for the antibiotic to be effective, four or more mg/dl must be present in the bloodstream. When do you have to take the antibiotic again? Solve using algebra, and solve graphically.

Q6) Stuart agrees to a house-painting job for \$900. He takes four days longer than expected, and he has earned \$18.75 less per day than expected. In how many days did he expect to complete the house?

Q7) On the 42 km go-cart course at Sportsworld, Arshia drives 0.4 km/h faster than Sarah, but she has engine trouble part way around the course and has to stop to get the go-cart fixed. This stop costs Arshia one-half hour, and so she arrives 15 min after Sarah at the end of the course. How fast did each girl drive and how long did each girl take to finish the course? Answer to one decimal place.

Q8) Huck Finn can paint a fence in 5 hours. After some practice, Tom Sawyer can now paint the fence in 6 hours.

a) How long would it take Huck and Tom to paint the fence together?

b) Tom demands a half-hour break while Huck continues to paint, and they finish the job together. How long does it take them to paint the fence?

c) Suppose they have to finish the fence in $3\frac{1}{2}$ hours. What's the longest break Tom can take?

Q9) Solve $\frac{x-8}{x} < 3-x$

Q10) Solve $\frac{x^2-2}{2} < \frac{6x^2-8x-1}{x+5}$

Q11) Solve $\frac{x^2-9}{x^2-1} < 0$

Q12) Solve $x \geq \frac{x+6}{x+2}$

Q13) If $T(x) = \frac{1}{\sqrt{1+\sqrt{x}}}$, find functions of x .

($f(x)$, $g(x)$, and $h(x)$) such that $f \circ g \circ h = T$. Each function must include the variable x .

Q14) Let f be the function defined by
 $f = \{(1, -3), (3, 2), (-3, -2), (-1, -4), (0, 0), (-2, 0), (-1, -4)\}$;
Let g be the function defined by
 $g = \{(-3, 4), (-2, 2), (-1, 0), (0, 1), (1, 3), (2, 4), (3, -1)\}$

Find the following values if they exist:

a) $(f \circ g)(x) = -3$

b) $(f \circ f \circ g)(0)$

c) $(f \circ f \circ f \circ f)(-2)$

d) $(f \circ g \circ f \circ g)(0)$

e) $(g \circ f \circ g \circ f)(0)$

f) $(g \circ g^{-1})(x) =$

g) $(g \circ f^{-1} \circ g^{-1})(2)$

h) $(\underbrace{f \circ f \circ \dots \circ f}_{n \text{ times}})(0)$

Q15) Given $f(x) = 3x - 2$ and $g(x) = \frac{x+2}{3}$

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

Q16) Given $f(x) = \frac{2}{x}$ and $g(x) = \frac{x}{x-2}$

Find the given compositions and their respective domains:

a) $(f \circ g)(x)$ b) $(g \circ f)(x)$ c) $(f \circ f)(x)$ d) $(g \circ g)(x)$

Q17) Given $f(x) = \frac{4x}{5-x}$, find $f^{-1}(x)$

Q18) Given $h(x) = \frac{1+2x}{7+x}$, find $h^{-1}(x)$

Q19) Solve for x Show your work.

a) $\sqrt{2x+1} = 3 + \sqrt{4-x}$

b) $\sqrt{x-2} + \sqrt{x-5} = 3$

c) $\frac{1}{3}x^{3/4}(x-3)^{-2/3} + \frac{3}{7}x^{-1/4}(x-3)^{1/3} < 0$

d) $x^{-1/3}(x-3)^{-2/3} - x^{-4/3}(x-3)^{-5/3}(x^2-3x+2) \geq 0$

Q20) Calculate the following sum

$$\left(\frac{e^x + e^{-x}}{2}\right)^2 - \left(\frac{e^x - e^{-x}}{2}\right)^2 = ?$$

Q21) Graph the following without using technology
Show work to receive credit.

$$y = \frac{2}{e^x + e^{-x}}$$

Q22) Graph the following without using technology
Show work to receive credit.

$$y = \frac{2}{e^x - e^{-x}}$$

Q23) Solve each of the following equations

a) $4 \log(1-5x) = 2$

b) $3 + 2 \ln\left(\frac{x}{7} + 3\right) = -4$

c) $2 \ln(\sqrt{x}) - \ln(1-x) = 2$

d) $\log x + \log(x-3) = 1$

Q24) Solve each of the following equations

a) $2e^{4x-2} = 9$

b) $10^{t^2-t} = 100$

c) $7 + 15e^{1-3z} = 10$

d) $x - xe^{5x+2} = 0$

Q25. Simplify or evaluate

a) $\log_4 7$

b) $\ln x^3 y^4 z^5$

c) $\log_3 \left| \frac{9x^4}{\sqrt{y}} \right|$

d) $\log \left| \frac{x^2 + y^2}{(x-y)^3} \right|$