Practice Questions to help you prepare for MA 15300 Final Exam

Open the bookmark panel by selecting the Bookmarks icon along the side margin to easier navigation.

Bring the following items to the final:

- ✓ your graphing calculator
- ✓ Number 2 pencils
- ✓ ID Number (Sign into **http://go.pfw.edu** to get your Student ID Number. You can also get it from your instructor.)

The final exam will evaluate how well you meet the course goals of MA 15300:

- Highlight the link of mathematics to the real world.
- Develop a wide base of mathematical knowledge, including
  - basic skills and concepts;
  - a functional view of mathematics, including graphical, analytical, numerical, and contextual viewpoints; Note: using these four representations is the *Rule of Four;*
  - properties and applications of some of the basic families of functions;
  - geometric visualization;
  - problem solving, predicting, critical thinking, and generalizing;
- Incorporate the use of general academic skills such as
  - communicating mathematics concepts;
  - understanding and using technology.
- Meet the eight Quantitative Reasoning Area 3 General Education proficiencies 3.1 to 3.8 applied to real-world problem solving.

Format of the exam:

The final exam will consist of entirely multiple-choice questions. You may certainly use your calculator (but not its manual). In fact, some questions will *require* a graphing calculator.
NO formula sheets, notes, books, or other external sources may be used.

How to prepare for the exam:

Note that the exam will NOT look exactly like these questions, so you should also review previous homework assignments, e-Homework (Möbius), quizzes, and tests, as well as material worked on during class meetings.

- **Topics from the last chapter on *Polynomial and Rational Functions* will receive more of an emphasis than earlier chapters.**
- Keep the *Rule of Four* (representing functions in words, graphs, tables, and formulas) in mind when solving problems, just as you have done throughout the semester.
- The actual final exam will have less questions than what is provided in this review.
- The worked out key is in your Brightspace course in the folder *Prepare for the Final Exam: Practice & Strategies*
- There you can also see the date, time, and location of the exam, which typically is **not** at the usual class meeting time or location.

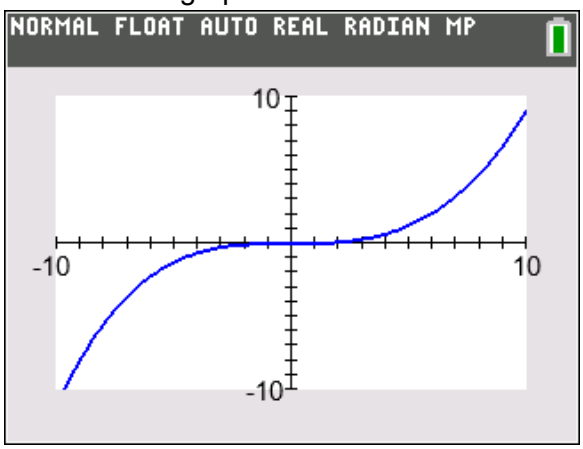
TIP: If you have printed this page or this document, write the following below:

Date of Final: _____

Time: _____

Room Location: _____ (typically this is not our usual classroom)

1) Your group is working together to determine the long run behavior of $y = 0.01x^3 - 0.0001x^4$.
One of your buddies, Eustace, uses his graphing calculator in the window $-10 \le x \le 10$ and $-10 \le y \le 10$ and sees the graph shown.



Eustace concludes that the long run behavior is as follows:
"As $x \to -\infty$, then $y \to -\infty$; as $x \to \infty$, then $y \to \infty$."

How should you respond?

A. "Good job, Eustace."
B. "Sorry, Eustace.
As $x \to -\infty$, then $y \to \infty$; as $x \to \infty$, then $y \to \infty$."
C. "Sorry, Eustace.
As $x \to -\infty$, then $y \to -\infty$; as $x \to \infty$, then $y \to -\infty$."
D. "Sorry, Eustace.
As $x \to -\infty$, then $y \to \infty$; as $x \to \infty$, then $y \to -\infty$."
E. "Sorry, Eustace.
As $x \to 0^-$ then $y \to 0$; as $x \to 0^+$, then $y \to 0$"

Questions 2-3 Smirch Reservoir
The volume of pollutants (in millions of cubic feet) in Smirch Reservoir is given by

$$P(t) = 360 + 9t,$$

where t is in years. The total volume of Smirch Reservoir (which includes both pollutants and water and also in millions of cubic feet) is gradually increasing and is given by

$$R(t) = 12000 + 12t.$$

Let $C(t)$ be the fraction of the reservoir's total volume that consists of pollutants.

Write an expression for $C(t) = \dfrac{P(t)}{R(t)}$ in terms of t and use your expression to answer the questions below.

2) In year $t = 0$, what percent of the reservoir's total volume consists of pollutants
A. 0.3% B. 3% C. $33\frac{1}{3}$ % D. $66\frac{2}{3}$ % E. None of these

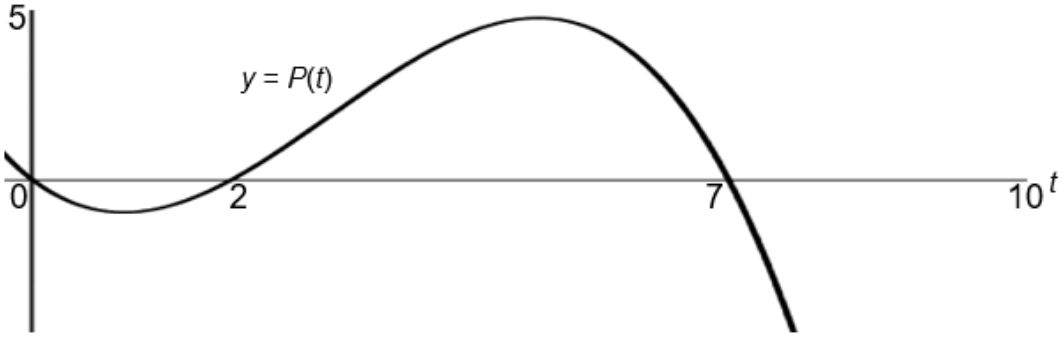
3) According to the mathematical model, if these trends were to continue for many, many years, about what percentage of Smirch Reservoir's total volume would eventually consist of pollutants?
A. 0.3% B. 3% C. $33\frac{1}{3}$ % D. $66\frac{2}{3}$ % E. None of these

Questions 4-5 Therapeutic Drug
The amount Q of drug present in body is $Q = 20(0.4)^t$, where Q is in milligrams at time t, and t is in hours.

4) What percent of the drug is lost per hour?
A. 4% B 20% C. 40% D. 6% E. 60% F. 80%

5) What is the growth factor?
A. 0.4 B. 4.0 C. 6.0 D. 20 E. 60 F. 80

Questions 6-8 Dr. Jekyll
Dr. Jekyll concocts a chemical reaction, whose temperature, in $^\circ C$ at time t, in seconds, is described by $P(t)$, a third degree polynomial whose graph is shown below. Suppose the temperature reached $-1^\circ C$ exactly 1 second after the reaction began. Assume all global behavior is shown. Note: the scales on each axis are not the same.

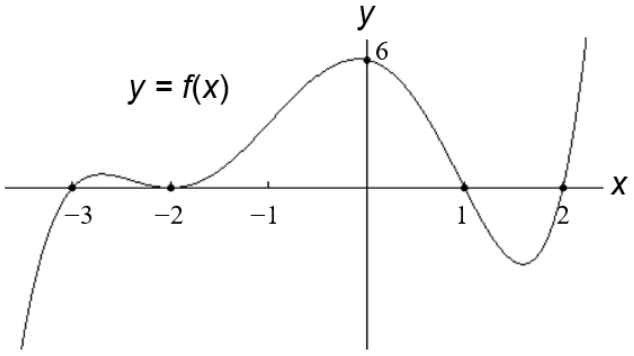


6) Determine the formula for $P(t)$. Then report the minimum temperature that the chemical reaction reaches in the first 10 seconds after it began.
A. $-1^\circ C$ B. $-10^\circ C$ C. $-20^\circ C$ D. $-40^\circ C$ E. None of these

7) A certain power function $Q(t)$ has the same long run behavior as $P(t)$, so much that $Q(t)$ and $P(t)$ look nearly indistinguishable if you graph both of these functions with technology and zoom out for very large values of t. This tells us that it would not be sensible to use $P(t)$ to model the temperature of the reaction for *all* $t \geq 0$. What is the formula for $Q(t)$?
A. $Q(t) = -t^3$ B. $Q(t) = t^3$ C. $Q(t) = -\frac{1}{6}t^3$ D. $Q(t) = \frac{1}{6}t^3$ E. None of these.

8) For what values of t does $P(t) = t$? This is when the temperature of the chemical reaction, in Celsius, is the same as the number of seconds since the reaction began. Select the best answer.
A. $t = 0$ B. $t = 0, 3, 4$ C. $t = 0, 3, 5$ D. $t = 0, 3, 6$ E. $t = 0, 4, 5$ F. $t = 0, 4, 6$

9) Construct a possible formula of least possible degree for the function $y = f(x)$. Then use your formula to report $f(3)$. Assume all global behavior is shown.



A. 30 B. 75 C. 306 D. 501 E. None of these

Questions 10-12 The Rotting Hill Debacle

The Pallidex pharmaceutical company has recently acquired the abandoned but historic Rotting Hill building and has decided to relocate its employees into this renovated building over a period of several days. The table gives $E(t)$, the number of employees moved t days after the building's acquisition.

***t*, days**	***E*(*t*), employees who relocated**
0	0
1	20
16	160

10) The data for $E(t)$ is modeled by a power function.
Construct the formula for $E(t)$. Which of the following would be closest to the value of $E(7)$?
A. 85 B. 86 C. 87 D. 88 E. 89

11) Unfortunately, many of the employees of Pallidex who have their offices relocated in the Rotting Hill building have contracted a mysterious disease which incapacitates them for weeks at a time. The table gives the number, $S(t)$, of Pallidex employees who have their offices located in the Rotting Hill building who have gotten sick t days after the initial acquisition of the building.

***t*, days**	***S*(*t*), sick relocated employees**
0	0
12	67
16	96

The data for $S(t)$ is modeled by a power function. Construct the formula for $S(t)$.
Which of the following would be closest to the value of $S(19)$?
A. 113 B. 115 C. 117 D. 119 E. 121

12) When the ratio of number of sick employees in a building to total number of employees in a building is greater than 0.75 the building is declared to have sick building syndrome and is closed down for health inspection. How many months after the Rotting Hill building is first acquired by Pallidex will it be closed for health inspection? Select the one closest to your answer.
A. 15 days B. 20 days C. 25 days D. 30 days E. 35 days

13) Use inverse properties and properties of logs to simplify the expression $e^{x \ln a}$. (Circle one.)
A. x^a B. e^{ax} C. $\frac{a}{x}$ D. ax E. a^x F. None of these

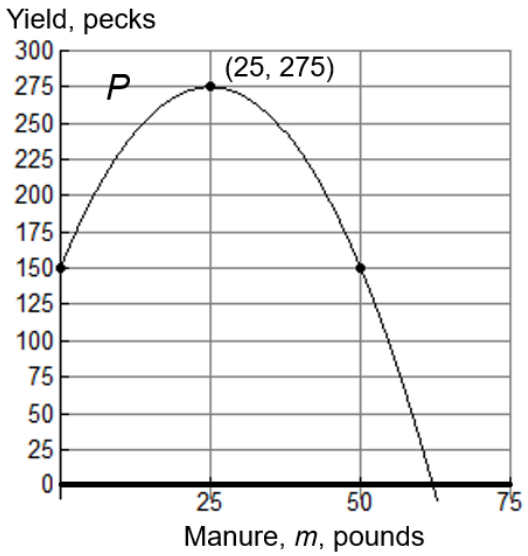
14) The table shows the volume of water, in gallons, every 30 minutes after it is being pumped at a constant rate. What is the average rate of change?

Time, *t*, min	**Volume, *V*(*t*), gal**
30	1075
60	1150
90	1225
120	1300

A. 75 gallons B. $\frac{0.4 \text{ minutes}}{\text{gallon}}$ C. $\frac{0.4 \text{ gallons}}{\text{minute}}$ D. $\frac{2.5 \text{ minutes}}{\text{gallon}}$ E. $\frac{2.5 \text{ gallons}}{\text{minute}}$

Questions 15-21 Peter Piper

Peter grows peppers. The yield, P, of peppers (in pecks) that Peter picks is a function of the amount, m, of fertilizer (in pounds) used, which is given by $P = f(m)$.



15) The statement $f(25) = 275$ means:
A. The yield ranges from 25 to 275 pecks of peppers.
B. When 25 lb of fertilizer is applied, the yield is a maximum of 275 pecks of peppers.
C. For every 25 lb of fertilizer added to the orchard, you increase the yield by 275 pecks.
D. When 275 lb of fertilizer is applied, the yield is 25 pecks of peppers.
E. You apply 25 to 275 pounds of fertilizer to the orchard.

16) The vertical intercept for the graph represents:
A. The maximum yield of the orchard.
B. The amount of fertilizer that must be applied to produce a maximum yield.
C. The yield without applying any fertilizer at all.
D. The initial amount of fertilizer applied to the orchard.
E. The amount of fertilizer that will kill all the trees and produce no yield at all.

17) Estimate the range.
A. $0 \le f(m) \le 60$ B. $150 \le f(m) \le 275$ C. $60 \le f(m) \le 150$ D. $60 \le f(m) \le 275$ E. $0 \le f(m) \le 275$

18) For what values of m is the function increasing?
A. $150 < m < 275$ B. $0 \le m < 275$ C. $0 \le m < 25$ D. $25 < m < 50$ E. $25 < m \le 60$

19) For what values of m is the function concave up?
A. $150 \le m \le 275$ B. $0 \le m \le 275$ C. $0 \le m \le 25$ D. $0 \le m \le 50$ E. None of these

20) For what values of m is $P > 150$?
A. $150 < m < 275$ B. $50 < m < 275$ C. $50 < m < 60$ D. $0 < m < 50$ E. None of these

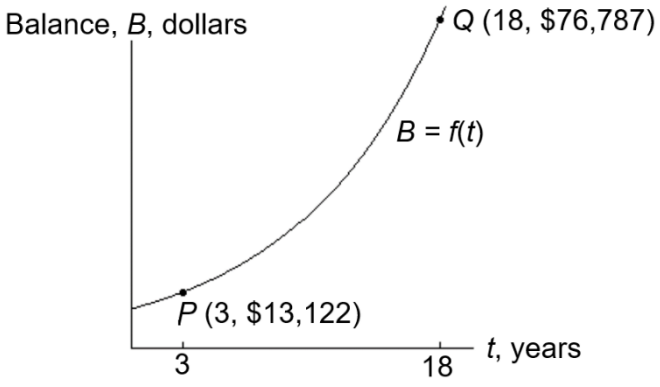
21) The function $f(m)$ is quadratic. Construct a formula for $f(m)$. Then answer the questions below.

a) Solve $f(m) = 230$ to the nearest whole number. Select the best answer.
A. $m = 10$ B. $m = 12$ C. $m = 40$ D. Both A and C E. Both B and C

b) Report the positive zero of $f(m)$ to the nearest whole number. Select the best answer.
A. $m = 60$ B. $m = 61$ C. $m = 62$ D. $m = 63$ E. $m = 64$

Questions 22-23 Show Me the Money

The graph gives the balance, *B,* of an investment in year *t*. Assuming the balance grows exponentially, construct a possible formula for $B = f(t)$.



22) What annual interest rate does the account pay?

A. 1.125% B. 11.25% C. 12.5% D. 34% E. 112.5% F. 125%

23) Which amount is closest to the initial balance?

A. $5,424 B. $5,454 C. $9,216 D. $10,122 E. $11,664 F. $41,812

24) An initial deposit of $4000 is made in a savings account for which the interest is compounded continuously. If the interest rate is 7.3%, how long will it take, to the nearest 0.01 year, for the investment to triple? Use $A = Pe^{rt}$.

A. 0.15 years B. 2.79 years C. 6.54 years D. 15.05 years E. None of these

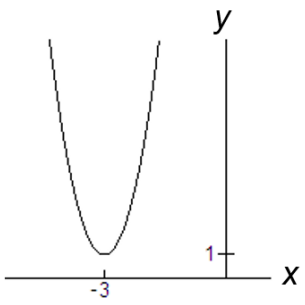
25) In year $t = 0$, the balance of an account is $2200. The account earns 3.82% annual interest, compounded **quarterly.** What is the amount in year *t*?

A. $2200(1.382)^{4t}$ B. $2200\left(1 + \frac{3.82}{4}\right)^{4t}$ C. $2200\left(1 + \frac{0.0382}{4}\right)^{4t}$ D. $2200\left(1 + \frac{0.0382}{4}\right)^{t}$ E. $2200\left(1 + \frac{0.382}{4}\right)^{4t}$

26) In year $t = 0$, the balance of an account is $2200. The account earns 3.82% annual interest, compounded **continuously**. What is the amount in year *t*?

A. $2200e^{1.382t}$ B. $2200e^{1.0382t}$ C. $2200(e \cdot 1.382)^{t}$ D. $2200e^{0.382t}$ E. None of these

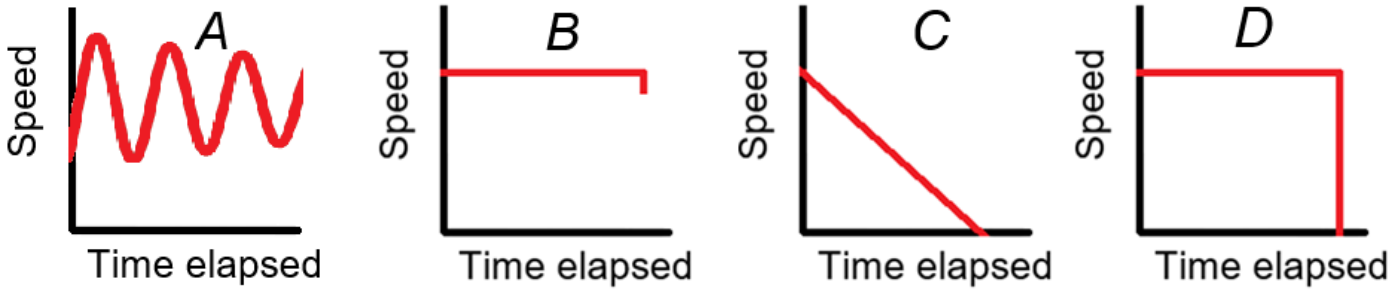
27) The graph of the function is a translation of $y = 5x^2$, shifted left 3 and up 1. Report the **range**.



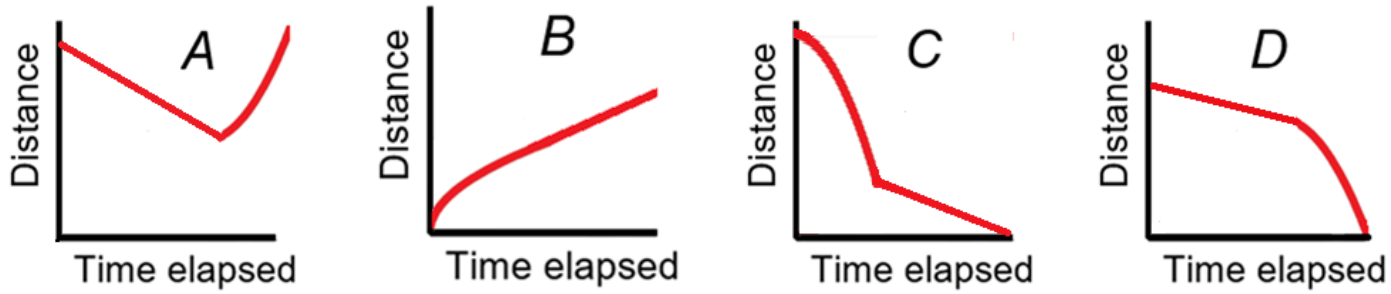
A. all real numbers B. $y \geq 1$ C. $y \geq -3$ D. $y \geq -1$ E. $y \leq 1$

Questions 28-32 Speed-Time Graphs and Distance-Time Graphs
Indicate which graph matches the statements. Note the choice of axes. All graphs are in the first quadrant.

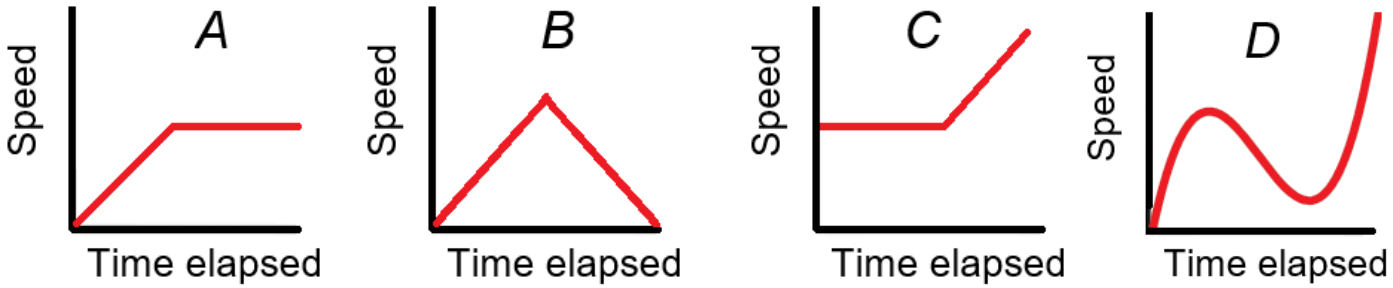
28) A train pulls into a station and lets off passengers.



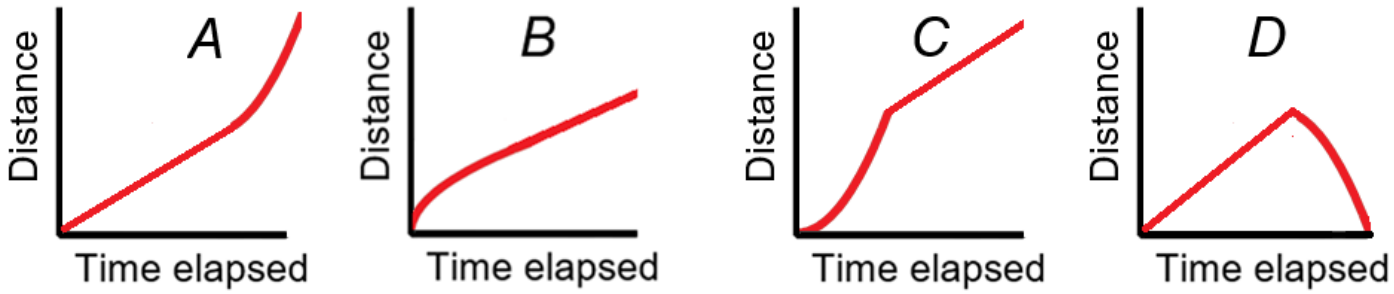
29) I start to walk to class at a slow steady rate. I hear the clock chimes and walk faster and faster to class.



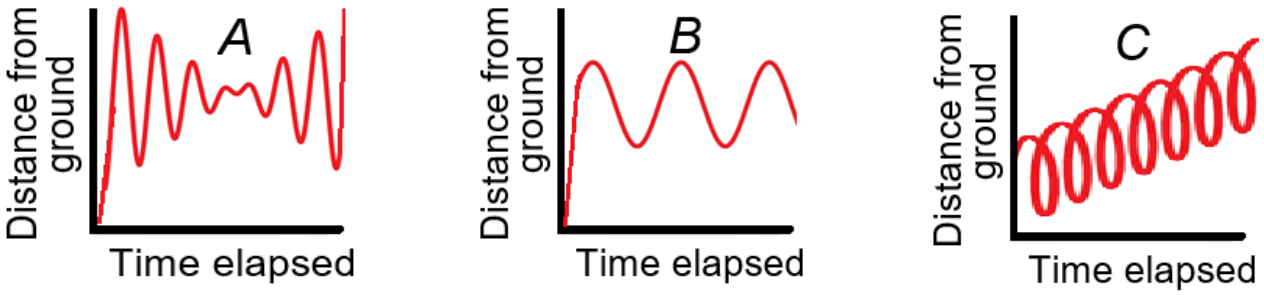
30) A rhino climbs a hill at a steady pace and then starts to run down one side.



31) A rhino climbs a hill at a steady pace and then starts to run down one side.



32) I board a Ferris Wheel platform and take a ride.



33) Given $f(x)=\frac{4}{x^2}$ and $g(x)=\sqrt{x^2+4}$, what is $f(g(x))$? Simplify.

A. $f(g(x))=\frac{4}{x^2+4}$ B. $f(g(x))=\frac{4}{\sqrt{x^2+4}}$ C. $f(g(x))=x^2+4$ D. $f(g(x))=\frac{4}{x^2\sqrt{x^2+4}}$ E. $f(g(x))=\frac{1}{x^2}$

34) Given $f(x)=\frac{\sqrt{x+1}}{2}$ and $g(x)=x^2+3$, what is $f(g(x))$? Simplify..

A. $f(g(x))=\frac{x+2}{2}$ B. $f(g(x))=\frac{\sqrt{x^2+4}}{2}$ C. $f(g(x))=x$ D. $f(g(x))=x+1$ E. $f(g(x))=\frac{(x^2+3)\sqrt{x+1}}{2}$

35) Assuming x, y, and w are positive real numbers, which of the following is $\log\frac{x^3y^2}{\sqrt{w}}$?

A. $x^3 + y^2 - \sqrt{w}$ B. $\frac{1}{3}\log x + \frac{1}{2}\log y - 2\log w$ C. $3\log x + 2\log y - \frac{1}{2}\log w$ D. $\frac{3\log x+2\log y}{\frac{1}{2}\log w}$

E. None of these

36) Solve for x to the nearest hundredth: $25^x = 3^{600}$

(Most calculators are unable to solve this numerically or graphically due to overflow problems.)

A. 409.56 B. 530.44 C. 204.78 D. No solution E. None of these

37) Report all the zeros of the polynomial function $f(x) = 400x(6x^2 - 42)$.

A. $0, \sqrt{7}$ B. $0, \sqrt{7}, 400$ C. $0, -\sqrt{7}, \sqrt{7}, 400$ D. $0, -\sqrt{7}, \sqrt{7}$ E. None of these

38) Report all the zeros of the polynomial function: $f(x) = -3(x^4 - 7x^2 - 6x)$. Hint: Use a graph or table.

A. 1, −3 B. −1, 3 C. −2, −1, 0, 3 D. −3, −2, −1, 0, 3 E. None of these

39) Report all possible values of x for which $9x^2(x + 6)(x - 6)^2 \geq 0$. Hint: use graphical reasoning.

A. $-6 \leq x \leq 6$ B. $-6 \leq x \leq 0$ or $x \geq 6$ C. $x \geq -6$ D. $x \leq 6$ E. None of these

40) Report the domain of $f(x) = \sqrt{x - 100}$.

A. $x \leq 100$ B. $x \geq 100$ C. $x \geq -100$ D. $x \leq -100$ E. None of these

41) Simplify $\ln\left(\frac{1}{\sqrt{e^x}}\right)$

A. $\frac{1}{x}$ B. $-x$ C. $-\frac{x}{2}$ D. $\frac{1}{\sqrt{x}}$ E. None of these

42) Which of the following is true about the graph of $y = f(x) = b^x$? List **all** correct answers.

I. It increases if $b > 1$
II. It decreases if $b < 0$
III. It has y-intercept (0, 1) if $b > 0$.

A. I, II and III B. I and II C. II and III D. I and III E. III only.

43) Use what you know about transformations and the graph of $y = \log x$ to answer the following about the graph of $f(x) = 2 + \log(x - 1)$. Which are true about the graph of $f(x) = 2 + \log(x - 1)$?
List **all** correct answers.

I. increases for all values of x in its domain.
II. crosses the x-axis at 1
III. never touches the y-axis
IV. passes through the point (2, 2).
Note: Don't be misled by limitations of graphing calculator technology when answering this question.

A. I, II and III B. I and II C. II and IV D. I and IV E. I, III and IV only.

44) The relationship of pH to the hydrogen ion concentration, C, is pH = –log C .
If the pH is 2.1, what is the hydrogen ion concentration?

A. 0.74 B. 0.008 C. 125.89 D. −0.322 E. −125.89

Questions 45-46 Logarithmic Equation

45) Which of the following is an acceptable first step to solve the equation $\ln 2x^3 = 5$?

A. $3\ln 2x = 5$ B. $2x^3 = e \cdot 5$ C. $2x^3 = \frac{5}{\ln}$ D. $2x^3 = e^5$ E. $\ln 2x^3 = \ln 5$

46) What is the correct **exact** solution to the equation $\ln 2x^3 = 5$?

A. $\sqrt[3]{\frac{5}{2\ln}}$ B. $\sqrt[3]{\frac{5e}{2}}$ C. $\sqrt[3]{\frac{e^5}{2}}$ D. $\sqrt[3]{\frac{5}{2}}$ E. $\frac{1}{2}e^{5/3}$

Questions 45-46 Exponential Equation

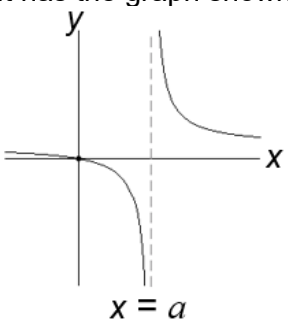
47) To solve the equation $20 = 3e^x + 5$, which of the following is an acceptable first step?

A. $4 = 3e^x$ B. $25 = 3e^x$ C. $\ln 20 = x\ln(3) + \ln 5$ D. $15 = 3e^x$ E. $\ln 20 = x\ln(3 \cdot e) + \ln 5$

48) Report the correct **exact** solution to the equation $20 = 3e^x + 5$.

A. $\frac{\ln 4}{\ln 3}$ B. $\ln \frac{4}{3}$ C. $\frac{\ln 25}{\ln 3}$ D. $\ln \frac{25}{3}$ E. $\ln 5$

49) A function passes through the origin and has a vertical asymptote at $x = a$, where $a > 0$.
It has the graph shown.



Which could be its equation?

A. $f(x) = \frac{1}{x-a}$ B. $f(x) = \frac{1}{x+a}$ C. $f(x) = \frac{x}{x-a}$ D. $f(x) = \frac{x}{x+a}$ E. $f(x) = \frac{x}{(x-a)^2}$

50) Let a be some constant. Which is true about $f(x) = \frac{2ax}{(x-a)^2}$?

A. Its horizontal asymptote is $y = 2a$.
B. Its horizontal asymptote is $y = 2$.
C. Its horizontal asymptote is $y = \frac{2a}{x}$.
D. Its horizontal asymptote is $y = 0$.
E. It has no horizontal asymptote.

Questions 51-54 deal with the function $f(x) = \frac{8x^2 - 8}{2x^2 - 4x}$.

51) Report all zeros.
A. 0, 2, and −2. B. 0, 1, and −1. C. 1 and −1. D. 2 and −2. E. 1, −1, and 8.

52) Report the equations of all vertical asymptotes.

A. The vertical asymptotes are $x = 0$, $x = -1$, $x = 1$, $x = 2$, and $x = -2$.
B. The vertical asymptotes are $x = 0$, $x = 1$, and $x = -1$.
C. The vertical asymptotes are $x = 0$, $x = 2$, and $x = -2$.
D. The vertical asymptotes are $x = 2$ and $x = -2$.
E. None of the above.

53) Report where the graph of $f(x) = \frac{8x^2 - 8}{2x^2 - 4x}$ crosses the y-axis.

A. The graph crosses at $y = 0$.
B. The graph crosses at $y = 4$.
C. The graph crosses at $y = 1$ and $y = -1$.
D. The graph crosses at $y = 16$.
E. The graph never crosses the y-axis.

54) The function has a horizontal asymptote.
a) Report its equation.
A. $y = 0$ B. $y = 1$ C. $y = 2$ D. $y = 4$ E. $y = 8$

b) Determine any values of x where $f(x)$ intersects its horizontal asymptote.
A. when $x = 0$. B. when $x = 0.5$. C. when $x = 0$ and 0.5 D. when $x = 0.5$ and 100
E. $f(x)$ never crosses its horizontal asymptote.

Questions 55-57 deal with the function $f(x) = \frac{63x^2}{36 - x^2} - 1$.

55) To report the zeros of $f(x) = \frac{63x^2}{36 - x^2} - 1$, which of the following is an acceptable step so far?

A. $\frac{63 \cdot 0^2}{36 - 0^2} - 1$ B. $36 - x^2 = 0$ C. $\frac{63x^2}{36 - x^2} = 1$ D. $\frac{63x^2 - 1}{36 - x^2} = 0$ E. $\frac{63x^2 - 36 - x^2}{36 - x^2} = 0$

56) Report the solution to the inequality $f(x) = \frac{63x^2}{36 - x^2} - 1 < 0$.

A. $-\frac{3}{4} < x < \frac{3}{4}$ B. $-6 < x < 6$ C. $-6 < x,\ x > 6$ D. $-\frac{3}{4} < x,\ x > \frac{3}{4}$ E. $x < -6,\ -\frac{3}{4} < x < \frac{3}{4},\ x > 6$

57) What is the horizontal asymptote of function $f(x) = \frac{63x^2}{36 - x^2} - 1$?

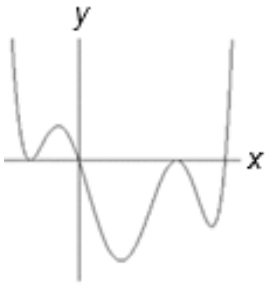
A. $y = 0$ B. $y = -1$ C. $y = 63$ D. There is no horizontal asymptote. E. None of these

58) In the year 1900 the population P of a town was 1160 people but it grew by 10 people every year.
In the year 1900 the population Q of a town was 1000. The town grew by 1.13% every year.
When does the population of Q first overtake the population of P? Select the response closest to the answer.
A. 1.3 years B. 39 years C. 70.9 years D. 116 years E. Q will never overtake P.

59) Admiral Boom fires a cannonball at the infamous *Black Pearl*, but the shot must clear the towering mainmast of Lord Cutler Beckett's flagship *HMS Endeavour* that sits between them, in the way. The cannonball's path, in ft, is $h(x)=0.96x-0.004x^2$, where x is the horizontal distance traveled. Find the maximum height of the cannonball.
A. 250 feet B. 240 feet C. 120 feet D. 57.6 feet E. None of these

60) The doubling time of a population is 12 years. What is its *tripling* time?
A. 4 years B. 15 years C. 19 years D. 36 years E. None of these

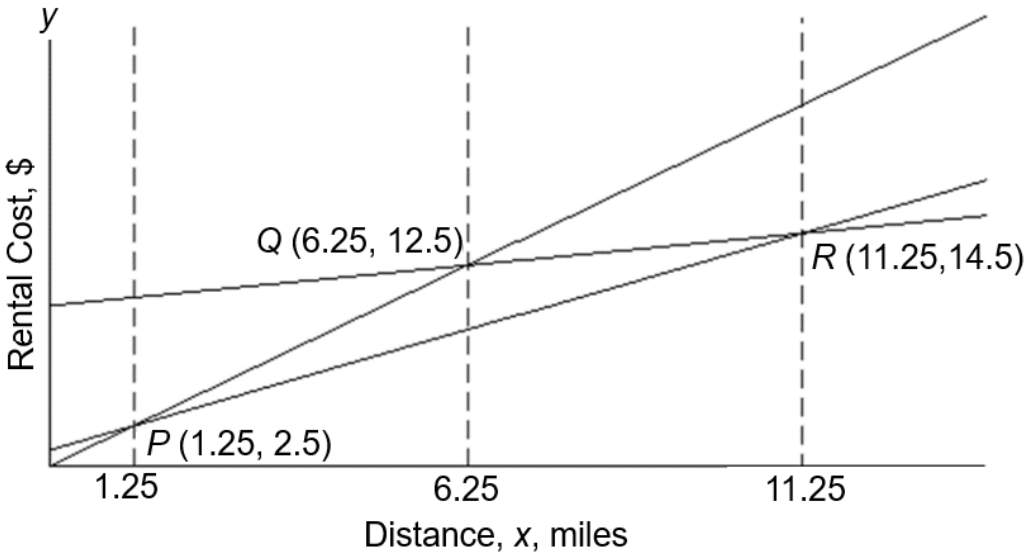
61) Assume all global behavior of the graph of a polynomial $f(x)$ is shown.
What is the least possible value for the degree of $f(x)$?



A. 3 B. 4 C. 5 D. 6 E. 7

62) To rent an electronic scooter you have three available options.
- To rent **Scooter A** you will be charged \$2 per mile.
- To rent **Scooter B** you will be charged \$10 plus \$0.40 per mile.
- To rent **Scooter C** you will be charged only \$1 plus \$1.20 per mile.

The graphs for the three scooter's rental costs are shown below.



Carefully label each graph with the correct scooter. Then answer the following question:
If x represents the number of miles driven, for which interval is **Scooter C** the cheapest?
A. $2.5 < x < 14.5$ B. $2.5 < x < 11.25$ C. $6.25 < x < 11.25$ D. $0 < x < 6.25$ E. None of these

Questions 63-64 Seabreeze Park

Seabreeze Park is a small amusement park that charges $11.00 for admission. An average of 800 people visit the park each day. Consultants predict that for each $1.00 increase in the entrance price, the park would lose an average of 50 daily customers.

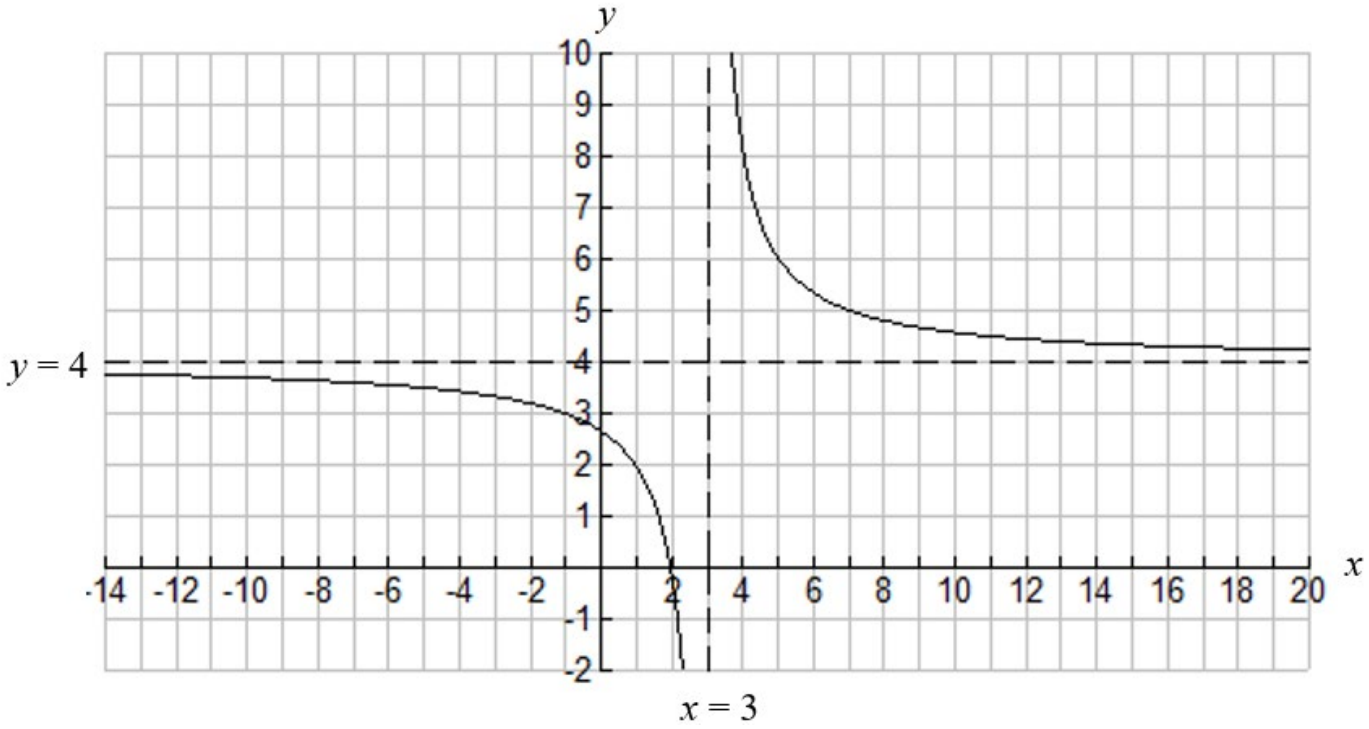
63) Construct a table of values which shows the entrance price, p, and number of tickets sold, N. Use the table to create a formula $N = f(p)$. Use the formula or your table to determine the axes intercepts. According to the model, which of the following are predicted?

A. A $27 ticket price would result in no customers.
B. If the park had free admission, they would have as many as 1,350 daily customers.
C. If the ticket price were $3.50, they would have 1175 daily customers.
D. Only 125 customers would be willing to pay a $24.50 admission price.
E. All of the above.

64) Add a third column to your table in Question **63** which gives the daily revenue, R, for each entrance price p. The *revenue* is the total amount received by the park before any costs are deducted, which is $R = N \cdot p$. For example, if the price p = $11, then N = 800 tickets are sold and the revenue $R = 800 \cdot 11$ = $8800. Let $R = g(p)$. Construct a formula for this function. According to the model, which is true?

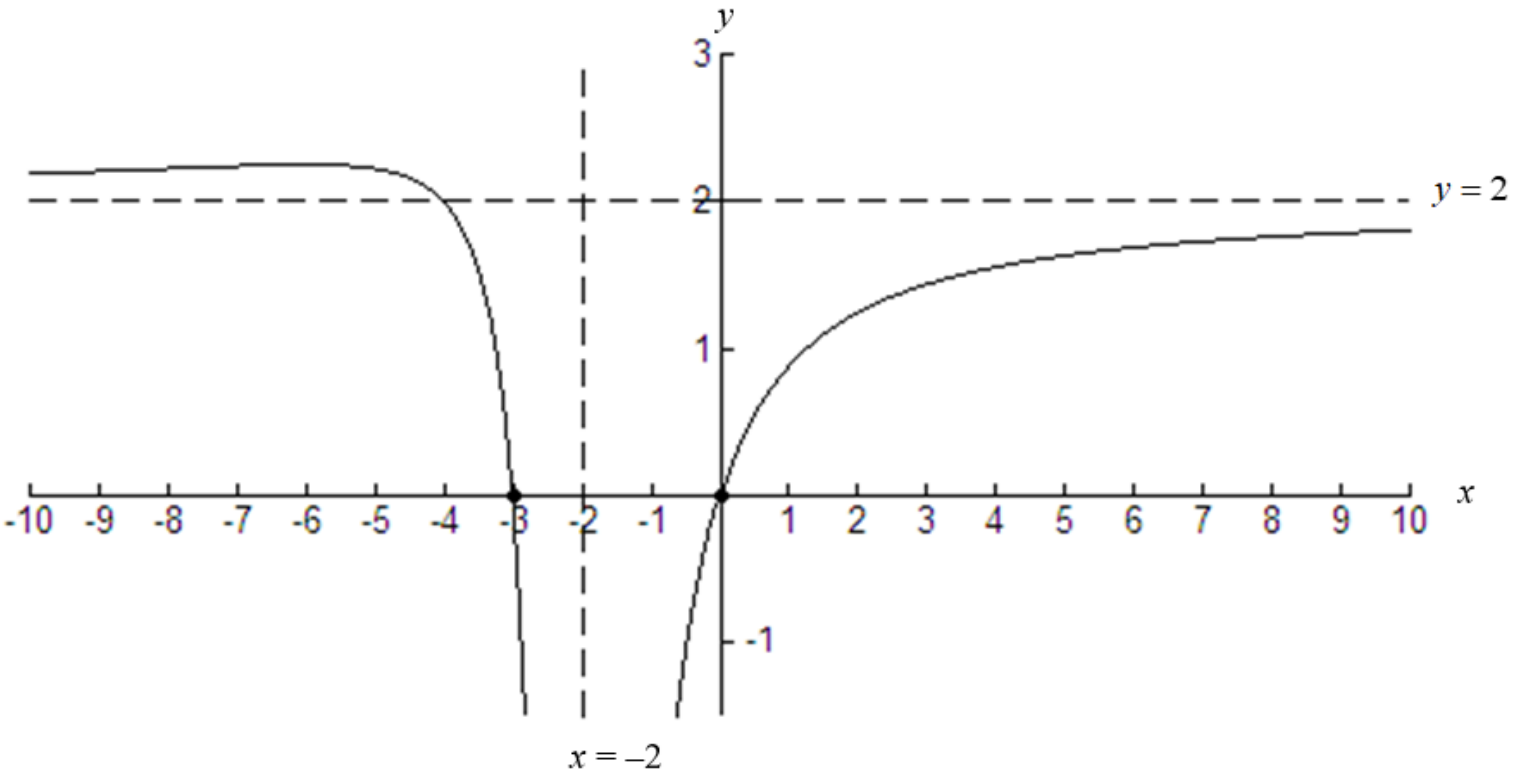
A. The higher they set the ticket price, the more revenue they will make.
B. A ticket price of $27 gives them the most revenue.
C. If the ticket price were $13, they would have the highest revenue of $9100.
D. If the ticket price were $14, they would have the highest revenue of $9100.
E. None of these

65) Give the formula for $f(x)$. It has a single zero at 2, a vertical asymptote at x = 3 and horizontal asymptote at y = 4. Use your formula to report $f(403)$. Tip: Use a table.



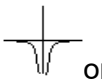
A. 4.1 B. 4.3 C. 4.01 D. 4.03 E. None of these

66) Report the formula for $f(x)$. It has zeros and asymptotes shown.
Using your formula, determine which of the following must be true? Tip. Use a table



A. $f(-1) = -4$
B. $f(1) = 1$
C. $f(-6) = 2.25$
D. Choices A and C are true.
E. None of these is true

67) A rational function $y = f(x)$ has the following properties:

- there is only one zero at 4,
- the short run behavior near that zero looks like a slanted line (as opposed to chair shape)
- there is one vertical asymptote at $x = 2$,
- the short run behavior near the vertical asymptote looks like  or 
- the degree of the denominator is the lowest degree possible,
- there is a horizontal asymptote of $y = 0$, and
- $f(0) = -8$

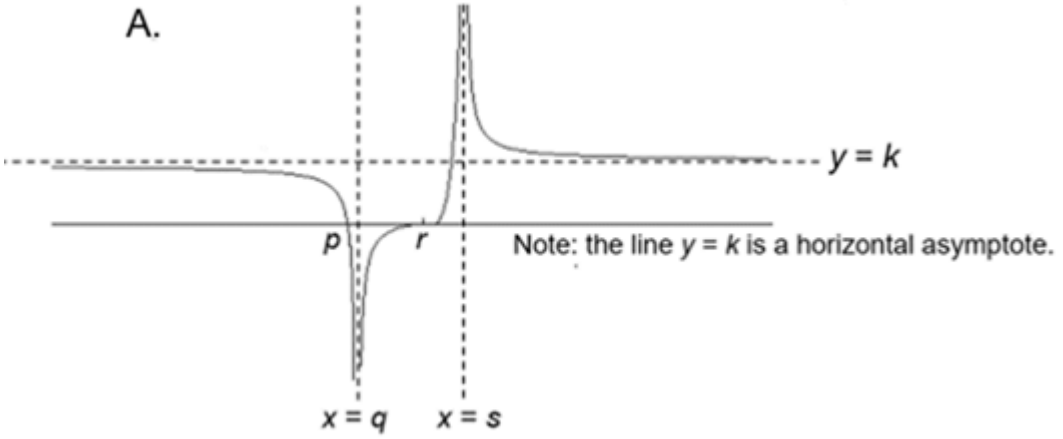
Construct the formula for $f(x)$. Then use your formula to report $f(3)$.

A. −16
B. −8
C. −4
D. 8
E. 16

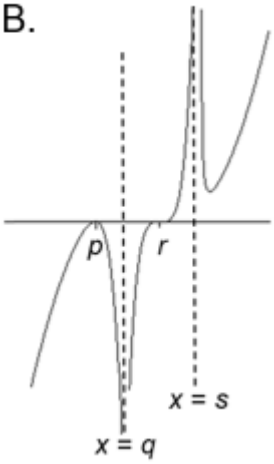
Questions 68-69 Rational Function Formula

68) If *k, p, q, r*, and *s* are all positive numbers, which of these looks most like the graph of $y = \frac{k(x-p)^2(x-r)^5}{(x-q)^2(x-s)^2}$?

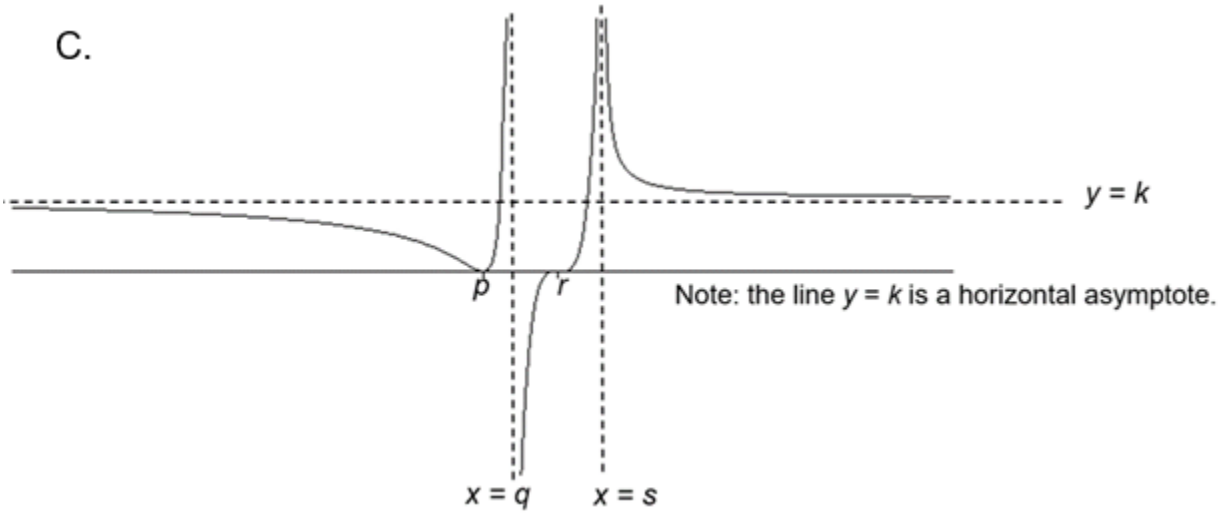
A.



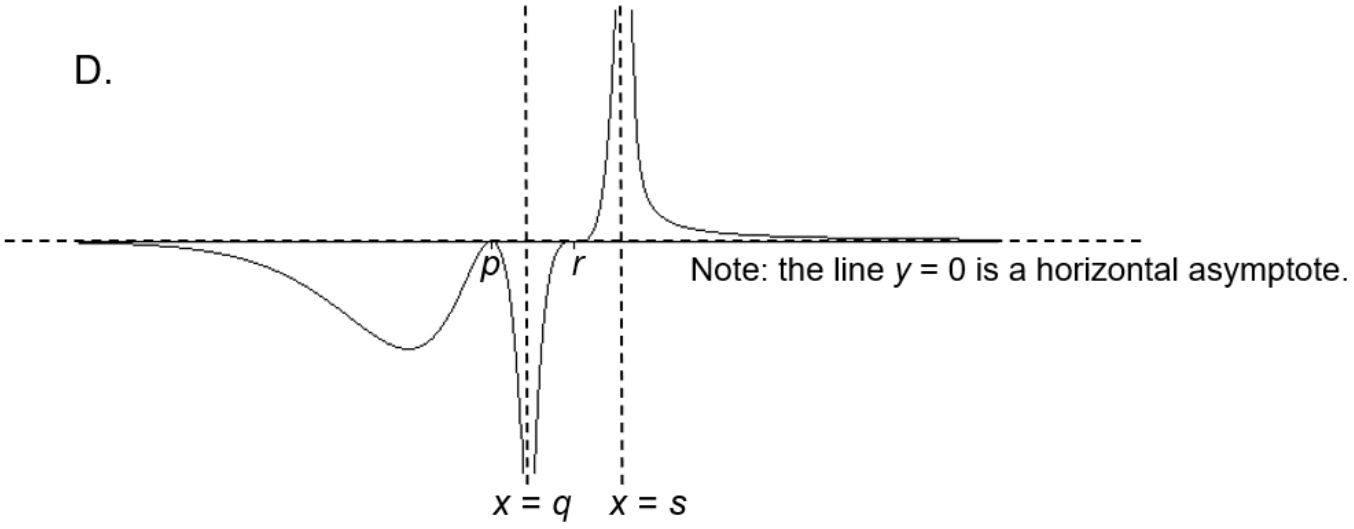
B.



C.



D.

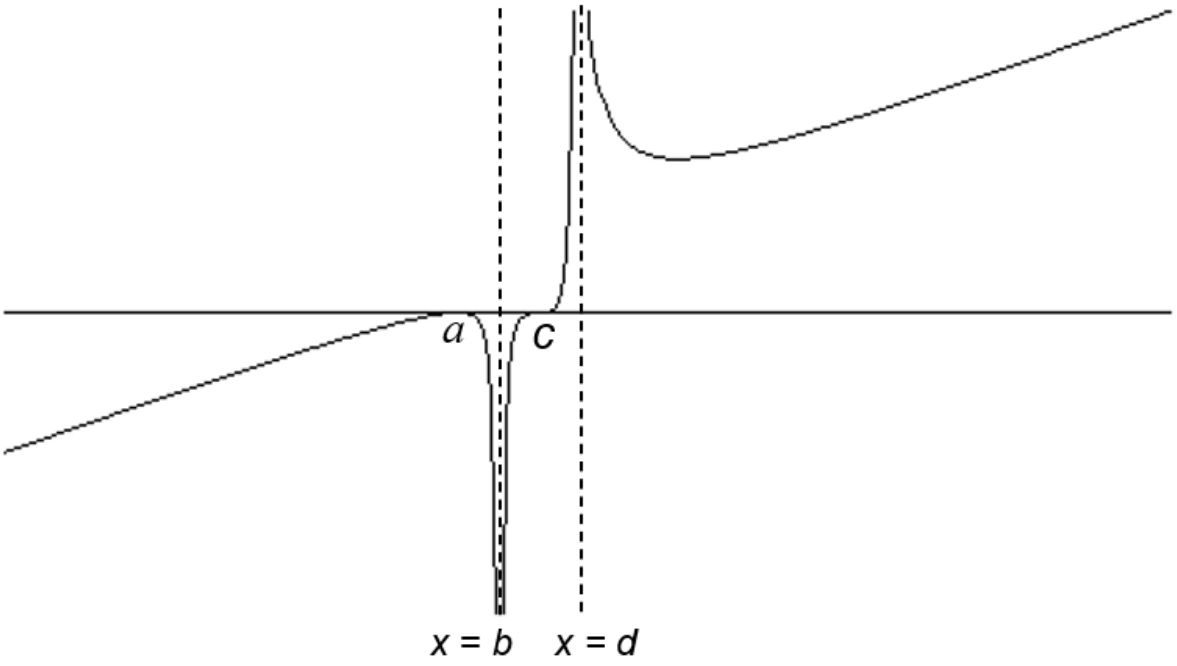


69) For more practice, give the following a try. (This is not a multiple-choice question.)
For each of the graphs not selected in the previous problem, write all possible formulas such that the power on each factor is as small as possible.
Your rational function formulas would involve *k, p, q, r*, and *s*.

70) Assume *a, b, c*, and *d* are positive real numbers.
The rational function *f*(*x*) graphed below has the following properties:

- short run behavior:
  - zeros are at *a*, *c*
  - vertical asymptotes are at $x = b$ and $x = d$

- long run behavior:
  as $x \to -\infty, y \to -\infty$
  as $x \to \infty, y \to \infty$
  Consequently, there is no horizontal asymptote



Assume *k* is some positive real number. Which could be its equation?

A. $f(x) = \dfrac{k(x-a)^2(x-c)^3}{(x-b)^2(x-d)^4}$

B. $f(x) = \dfrac{k(x-a)^2(x-c)^3}{(x-b)^2(x-d)^2}$

C. $f(x) = \dfrac{k(x-a)^2(x-c)^3}{(x-b)^2(x-d)}$

D. $f(x) = \dfrac{k(x-a)^4(x-c)^3}{(x-b)^3(x-d)^4}$

E. $f(x) = \dfrac{k(x-a)^2(x-c)^3}{(x-b)(x-d)^3}$

Questions 71-75 Graph Properties
For each of the descriptions below, decide which graph or graphs (A–G) are most appropriate.

A.  B.  C.  D.  E.  F.  G. _____

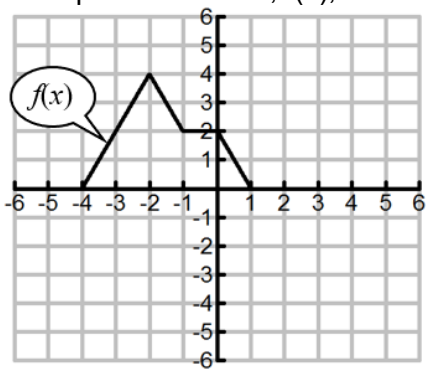
71) The function has a positive rate of change and concave up.
72) The function is concave down.
73) The function is decreasing.
74) The function is constant.
75) The average rate of change of the function over every interval is constant.

Questions 76-80 Modeling with a Graph
Each scenario below describes how one quantity changes relative to another over time. Select the graph (A–G) that could model the situation.

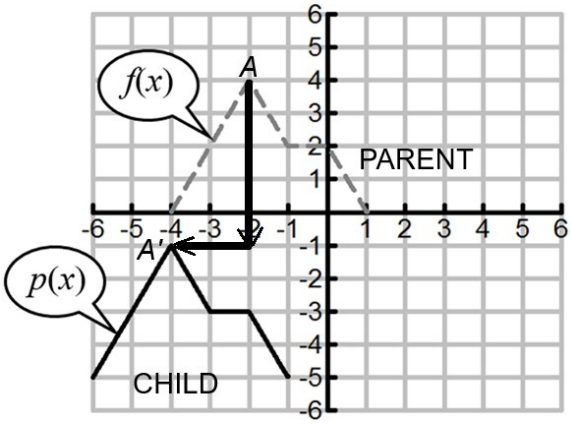
A.  B.  C.  D.  E.  F.  G. _____

76) "Even though the child's temperature is still rising, the penicillin seems to be taking effect."
77) "Your distance from the Atlantic Ocean in kilometers, increases at a constant rate."
78) "At first your balance grows slowly, but its rate of growth continues to increase."
79) "The annual profit is decreasing. Each year it falls more steeply than the previous year."
80) ""The population of rhinos isn't decreasing as quickly as it used to be."

Questions 81-83 Transformations of a Graph
The graph of the parent function, $f(x)$, looks like a chair facing east. We explore possible child functions of $f(x)$.

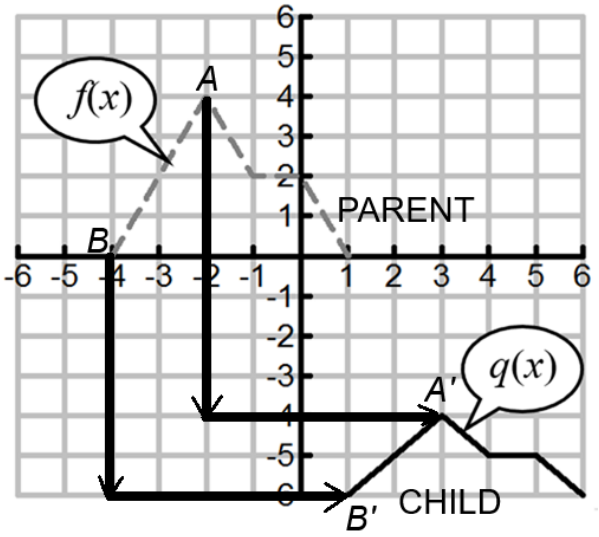


81) The graph of the child function $p(x)$ is a relocated version of the parent function $f(x)$ with the same shape. Both graphs resemble a chair facing east. Arrows show how A (−2,4) on $f(x)$ maps to its corresponding point A' (−4, −1) on $p(x)$. Write a rule for the child function $p(x)$ in terms of the parent function $f(x)$.



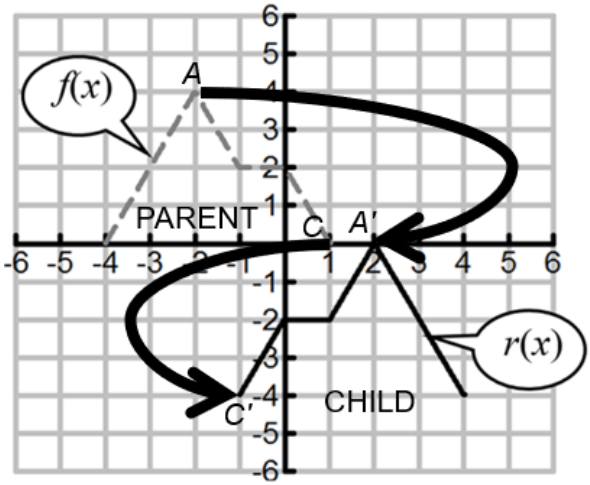
A. $p(x) = f(x+2) - 5$ B. $p(x) = f(x-2) - 5$ C. $p(x) = f(x+2) + 5$ D. $p(x) = f(x-2) + 5$ E. None of these

82) The graph of the child function $q(x)$ is a smaller, relocated version of the parent function $f(x)$, with both graphs resembling a chair facing east. Arrows show how points correspond between the graphs: A (−2,4) on $f(x)$ maps to A' (3, −4) on $q(x)$; B (−4, 0) on $f(x)$ maps to B' (1, −6) on $q(x)$. Write a rule for the child function $q(x)$ in terms of the parent function $f(x)$.



A. $q(x) = f(x+5) - 6$ B. $q(x) = f(x-5) - 6$ C. $q(x) = f(x+5) + 6$ D. $q(x) = 0.5f(x+5) - 6$
E. $q(x) = 0.5f(x-5) - 6$

83) The graph of the child function $r(x)$ is a relocated version of the parent function $f(x)$ with the same shape, but while the parent $f(x)$ resembles a chair facing east, the child $r(x)$ resembles a chair facing west. Arrows show how points correspond between the graphs: A (−2,4) on $f(x)$ maps to A' (2, 0) on $r(x)$; C(1, 0) on $f(x)$ maps to C' (−1, −4) on $r(x)$. Write a rule for the child function $r(x)$ in terms of the parent function $f(x)$.



A. $r(x) = -f(x+3) - 4$ B. $r(x) = -f(x-3) - 4$ C. $r(x) = f(-x) - 4$ D. $r(x) = -f(x) - 4$
E. $r(x) = f(-x-3) - 4$

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- This set of Practice Questions and its Answer Key with worked out solutions.
- NotebookLM: AI-generated review tool. (Always double-check its math!)
- Just for Practice Sets & Flash Cards: 100% human-created practice
- Live Review Session: Exam day from 1:00 PM – 3:00 PM. Hosted by real humans. Check Brightspace for the room location.
- And more.