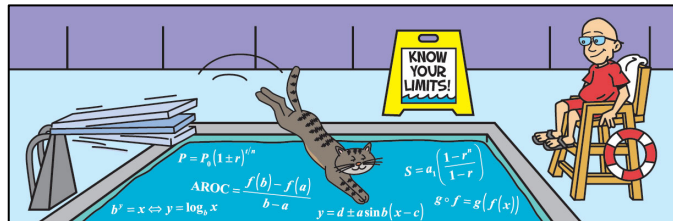


Diving In

AP Precalculus



1.1a) Functions, Domain and Range (No Calculator)

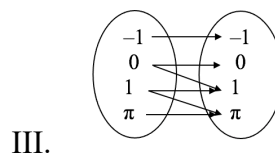
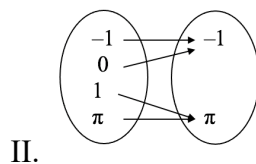
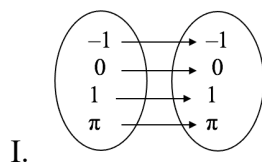
1. Find the domain of $f(x) = \sqrt{\frac{-3}{x+3}}$

- A) $x \neq -3$ B) $(0, \infty)$ C) $(-\infty, -3)$ D) $(-3, \infty)$

2. Find the range of $f(x) = \frac{1}{x^3}$ for $-1 \leq x \leq 1$

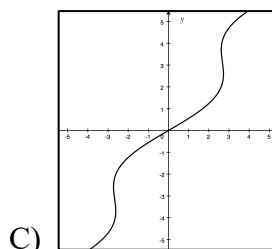
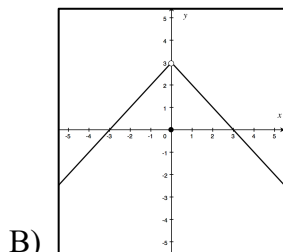
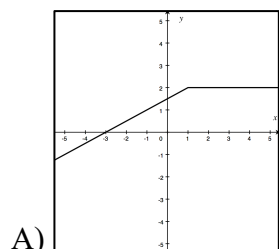
- A) $x \neq 0$ B) $(-\infty, -1]$ or $[1, \infty)$ C) $[-1, 1]$ D) $[-1, 0)$ or $(0, 1]$

3. Which of the following mappings are functions?



- A) I only B) II only C) I and II only D) I, II and III

4. Which of the following graphs fails to represent a function?



- D) None do

5. Let $f(x) = \sqrt{12 + 4x - x^2}$

a. Find the domain of $f(x)$. **(3)**

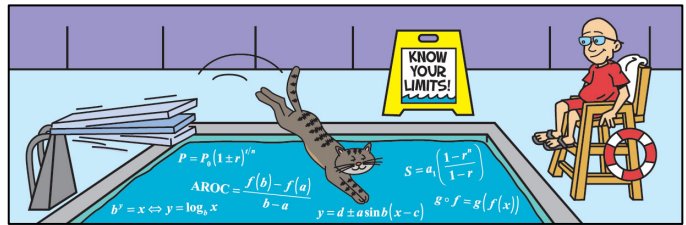
b. Find the range of f . Justify your answer. **(2)**

c. Let $g(x) = \frac{f(x)}{x}$ with x an integer. What is the domain of g ? **(1)**

d. What is the range of g ? **(2)**

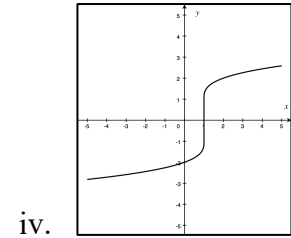
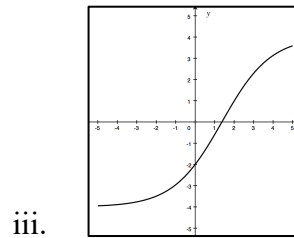
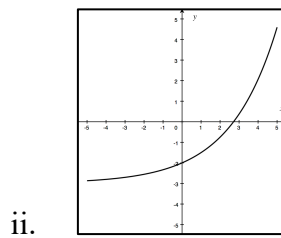
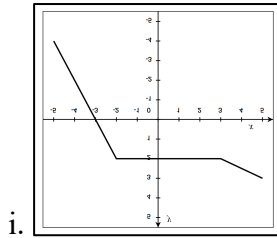
Diving In

AP Precalculus



1.1b) Functions, Domain and Range (Calculator)

1. Let m be the number of functions that are increasing on $[-5, 5]$ and n be the number of graphs that are strictly increasing on $[-5, 5]$. Find the value of $m - n$.



A) 3

B) 2

C) 1

D) 0

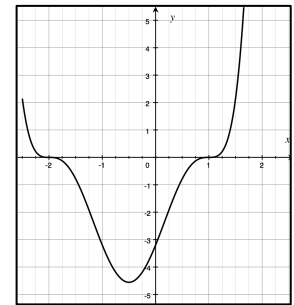
2. The graph to the right is $f(x)$ whose domain is $[-2.5, 2.5]$. Approximately what percentage of x -values is the graph of f concave down?

A) 30%

B) 35%

C) 50%

D) 60%



3. Determine the number of zeros of $f(x) = \frac{x^5 - 2x^4 - 6x^3 + 8x^2 + 5x - 6}{x - 1}$

A) 6

B) 5

C) 4

D) 3

4. Which of the following functions appears to have an inflection point at one of its zeros?

I. $y = (x - 3)^3$

II. $y = (x - 3)^{1/3}$

III. $y = x^2 - x^3$

A) I only

B) II only

C) I and II only

D) I, II, and III

5. Let $f(x) = b - ax$

a. For what values of a is $f(x)$ be increasing on $(-\infty, \infty)$? Explain your reasoning. **(2)**

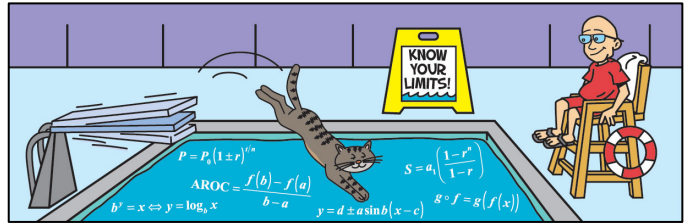
b. If $g(x) = f(x^2)$, $a > 0$, find the zero(s) of g . **(2)**

c. Determine intervals where $g(x)$ is increasing and decreasing. Give a reason for your answer. **(2)**

d. Determine an interval where $g(x)$ is concave up and an interval where $g(x)$ is concave down. Also give the x -value of the inflection point if it exists. Give a reason for your answer. **(2)**

Diving In

AP Precalculus



1.2) Rates of Change (No Calculator)

1. Find the average rate of change of $f(x) = x^2 + 4x - 3$ over $\left[-\frac{1}{2}, \frac{1}{4}\right]$

A) $\frac{15}{4}$

B) 3

C) $\frac{1}{12}$

D) $\frac{-19}{12}$

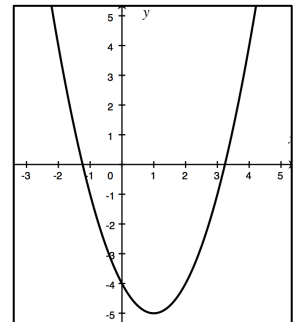
2. To the right is a graph of $f(x)$. For what approximate value of x is the instantaneous change of f equal to the average change of f between $x = -1$ and $x = 4$?

A) $x = 0$

B) $x = 1$

C) $x = 1.5$

D) $x = 2$



3. Find an integer approximation to the instantaneous rate of change of $f(x) = x^3 + x^2 - 3x$ at $x = -1$.

A) -2

B) -1

C) 0

D) 1

4. A roller coaster travels takes one minute to climb a lift hill, a distance of 150 feet. It takes very little time to descend the hill, a distance of 90 feet. If v represents the average speed of the coaster for traversing the hill in miles per hour, which of the following represents an accurate statement about v ?

A) $v < 2.73$

B) $v < 4$

C) $v > 4$

D) $v < 90$

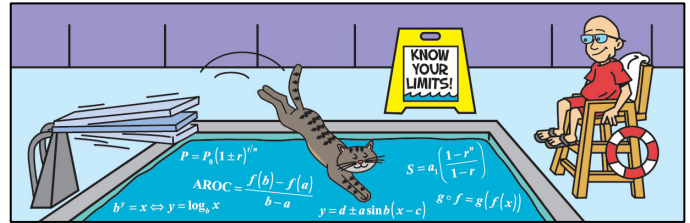
1.2) Rates of Change

5. Let $f(x) = \frac{-1}{x^2}$

- a. Find the average rate of change of $f(x)$ over $[-4, -2]$. Show how you got your answer. **(2)**
- b. Find the average rate of change of $f(x)$ over $[a, b]$, $a, b > 0$. Use this formula to determine the average rate of change if b is always twice a . **(3)**
- c. An approximation to the instantaneous rate of change of f , accurate to 2 decimal places, at $x = 2$ can be found in two ways. Show the difference in approximations using each method. **(3)**

Diving In

AP Precalculus



1.3) Change: Linear, Quad. Functions (No Calculator)

1. Given the quadratic function $f(x) = x^2 - 7x$ with increment 1 find a formula to find the average rate of change of f at any value x and use it to find the average rate of change of f at $x = 125$.
- A) 242 B) 244 C) 250 D) 256
2. You are given the quadratic function $f(x) = -5x^2 + 3x - 2$ with increment 2. Find $g(x)$ that will give the average rate of change of f at any value of x .

- A) $g(x) = -7x - 2$ B) $g(x) = -14x - 2$ C) $g(x) = -20x - 7$ D) $g(x) = -10x - 7$

3. A function is defined on $[-0.5, 0.5]$ according to the table to the right. Describe the behavior of the function in that interval.

x	-0.5	-0.25	0	0.25	0.5
$f(x)$	-20.9	-13.9	-8.3	-4.1	-1.3

- A) Increasing, concave up B) Increasing, concave down
C) Decreasing, concave up D) Decreasing concave down

4. Given a function f on $[-0.2, 0.2]$ as shown in the table to the right, determine the interval where f has an inflection point.

x	-0.2	-0.1	0	0.1	0.2
$f(x)$	24.5	16.0	10.0	4.5	-1.2

- A) $(-0.2, -0.1)$ B) $(-0.1, 0)$ C) $(0, 0.1)$ D) $(-0.1, 0.2)$

1.3) Change in Linear and Quadratic Functions

5. Given $f(x) = 4x^2 - 10x + 1$, a formula needs to be developed to calculate the average rate of change of f on any interval $[x, x+0.5]$

a. Complete the table **(2)**

x	0	1/2	1
$f(x)$			
AROC			XXX

b. Use the table values to determine the average rate of change formula and use it to find the average rate of change between $x = -22.2$ and $x = -21.7$. **(1)**

c. Let $g(x) = h(x) \cdot f(x)$ for some function h . The values of $g(x)$ are given in the table. Find the average rate of change of g between consecutive values of x . **(2)**

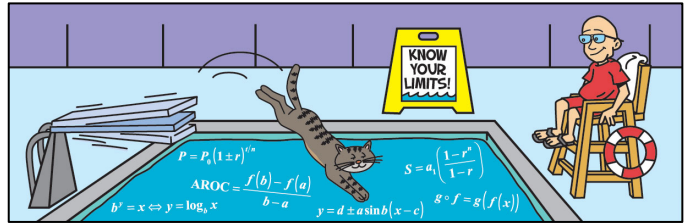
x	-1/2	0	1/2	1
$g(x)$	7	0	-3	-10
AROC				XXX

d. Let $x = k$ be a point of inflection of $g(x)$. Determine the smallest interval that can ascertain the location of k . Give a reason for your answer. **(2)**

e. Using information from parts c and d, determine the intervals of concave up and concave down for g in terms of k . **(1)**

Diving In

AP Precalculus



1.4) Polynomials (Calculator)

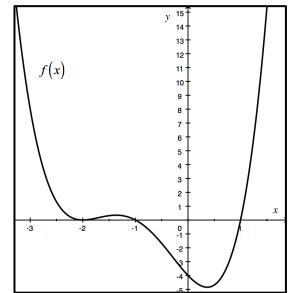
1. Let $f(x) = -10x^2 - 15x + 31$. If $g(x) = \frac{-1}{3}f(x)$, which of the following is true about the graph of $g(x)$?

- I. They both have no zeros
- II. They have the same zeros
- III. g is narrower than f
- IV. g is wider than f

- A) I and III
- B) II and III
- C) I and IV
- D) II and IV

2. In the graph to the right whose domain is $(-\infty, \infty)$, count the total number of zeros, relative maximum points, relative minimum points, absolute maximum point, absolute minimum points and inflection points.

- A) 7
- B) 8
- C) 9
- D) 10



3. A polynomial has 4 real zeros, none of which is the location of a relative minimum or relative maximum. Which of the following must be true about its graph?

- I. 2 relative max, 1 relative min, an absolute max and no absolute min
- II. 2 relative min, 1 relative max, an absolute min and no absolute max
- III. 1 relative max, 1 relative min, an absolute max and absolute min

- A) I only
- B) I and II only
- C) III only
- D) I, II and III

4. Which of the following polynomials is decreasing on $(-\infty, \infty)$ and has an inflection point at the origin?

- I. $f(x) = -x^{1/3}$
- II. $f(x) = -x^3$
- III. $f(x) = -4x^5 - x^2$

- A) I and II only
- B) II only
- C) II and III only
- D) I, II and III

1.4) Polynomials

5. Given the graph defined by $f(x) = 4x^2 + 4x - 3$

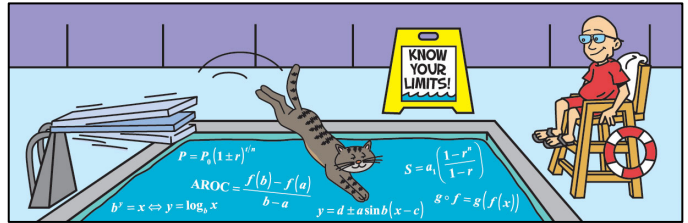
a. Determine the intervals where f is increasing and decreasing and the zeros of f . Show your reasoning. **(3)**

b. Let $g(x) = [f(x)]^2$. Examine its graph and determine i) points of relative minima, ii) approximate point of relative maximum, iii) approximate x -location of inflection points. **(3)**

c. Let $h(x) = f(x^2)$. Determine algebraically, the zeros of the function and graphically, the location of the absolute minimum and absolute maximum if they exist. **(2)**

Diving In

AP Precalculus



1.5a) Polynomials and Their Zeros (No Calculator)

1. Which of the following are true?

- I. The quotient of any two rational numbers is always rational.
- II. The product of any two irrational numbers can be rational.
- III. The quotient of any two pure imaginary numbers can be irrational.

- A) I and II only B) I and III only C) II and III only D) I, II and III

2. A polynomial has 2 real roots and 2 turning points. What is the classification of the polynomial with the smallest degree that fits that classification.

- A) linear B) quadratic C) cubic D) quartic

3. The remainder when $x + 2$ is divided into $x^3 - 10x - 8$ is

- A) 4 B) 0 C) 16 D) -20

4. Let $f(x)$ be a polynomial where the absolute value of the leading coefficient and the constant term are both equal to 6. Using the rational zero test, how many possible rational roots are there?

- A) 9 B) 11 C) 18 D) 20

5. Let $f(x) = 2x^3 - 23x$ and $g(x) = 3x^2 - 12$

a. Find the zeros of $f(x)$ and give their nature. **(2)**

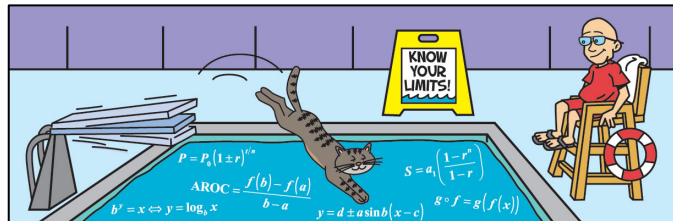
b. Find the zeros of $g(x)$ and give their nature. **(1)**

c. Find the possible rational roots of $f(x) - g(x)$ **(2)**

d. Show that $x = 4$ is a zero of $f(x) - g(x)$ and find the other roots, giving their nature. **(3)**

Diving In

AP Precalculus



1.5b) Polynomials and Their Zeros (No Calculator)

1. Determine the number and nature of the roots of $f(x) = x^4 + 2x^2 - 8$

- A) 4 real B) 2 rational, 2 irrational C) 2 rational, 2 imaginary D) 2 irrational, 2 imaginary

2. $i + 1$ is a root of a quadratic $f(x)$. Find $f(x)$.

- A) $f(x) = x^2 - x + 1$ B) $f(x) = x^2 + 2$ C) $f(x) = x^2 - 2x - 2$ D) $f(x) = x^2 - 2x + 2$

3. Find the number of unique complex zeros for $f(x) = x^7 + 2x^5 + x^3$.

- A) 2 B) 3 C) 4 D) 7

4. Values of polynomial $f(x)$ for successive values of x are given. $-32, -10, -2, -2, -4, -2$. Find the next term.

- A) 6 B) 8 C) 10 D) 12

1.5b) Polynomials and Their Zeros

5. Let $h(x) = x^4 + 10x^3 + 37x^2 + 72x + 80$. $h(x)$ can be written as $f(x)g(x)$ where f and g are quadratics.

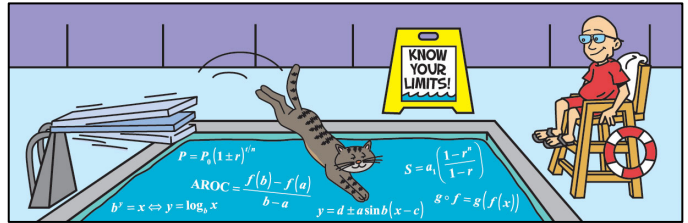
a. If $-1 - 2i$ is a root, find $f(x)$. Show your analysis. **(3)**

b. Find $g(x)$. **(4)**

c. If $h(x)$ is fully factored, find the multiplicity of each linear factor. **(1)**

Diving In

AP Precalculus



1.6) End Behavior (No Calculator)

1. Below, there are 6 functions. Determine how many of them are even (E), odd (O), and neither (N).

I. $f(x) = 2x + 2$

II. $f(x) = 5$

III. $f(x) = 3x^2 - 7$

IV. $f(x) = x^5 - 4x^3 + 2x$

V. $f(x) = \frac{x^4 - 4x^2 + 9}{x}$

VI. $f(x) = \frac{x^3 - 27}{x - 3}$

A) 2E, 2O, 2N

B) 1E, 3O, 2N

C) 1E, 4O, 1N

D) 3E, 2O, 1N

2. If $f(x)$ is a polynomial such that $\lim_{x \rightarrow \infty} f(x) = -\infty$ and $\lim_{x \rightarrow -\infty} f(x) = -\infty$, then which are possible classifications of f ?

I. Even

II. Odd

III. Neither

A) I only

B) II only

C) I and III only

D) II and III only

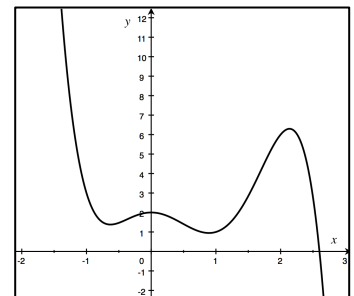
3. Match the graph to the only possible function.

A) $y = -x^6 + 4x^2 + 2$

B) $y = 3x^4 - 3x^2 + 2$

C) $y = x^5 - 3x^4 - 3x^2 + 2$

D) $y = -x^5 + 3x^4 - 3x^2 + 2$



4. If $f(x) = -3x^2 + x - 1$ and $g(x) = -2x^4 + x^3 - 6x^2 - 5x + 3$, which is the end behavior of $f(x)g(x)$?

A) $\lim_{x \rightarrow -\infty} f(x)g(x) = -\infty$
 $\lim_{x \rightarrow \infty} f(x)g(x) = -\infty$

B) $\lim_{x \rightarrow -\infty} f(x)g(x) = -\infty$
 $\lim_{x \rightarrow \infty} f(x)g(x) = \infty$

C) $\lim_{x \rightarrow -\infty} f(x)g(x) = \infty$
 $\lim_{x \rightarrow \infty} f(x)g(x) = -\infty$

D) $\lim_{x \rightarrow -\infty} f(x)g(x) = \infty$
 $\lim_{x \rightarrow \infty} f(x)g(x) = \infty$

1.6) End Behavior

5. Given $f(x) = -(x^5 - x^4 - 2x^3 + 2x^2 + x - 1)$ **(1)**

a. Express the end behavior of f using limits.

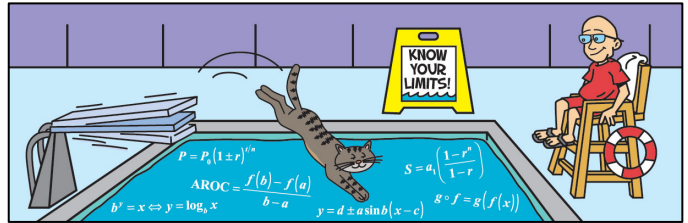
b. Completely factor $f(x)$. **(4)**

c. Find the zeros of $f(x)$. **(1)**

d. Describe the behavior of the graph of $f(x)$ at the zeros based on multiplicities. **(2)**

Diving In

AP Precalculus



1.7a) Polynomial Modeling (No Calculator)

1. $y = |x - 4| - 4$ can be written as

- A) $y = \begin{cases} x - 8, & x \geq 4 \\ 8 - x, & x < 4 \end{cases}$ B) $y = \begin{cases} x - 8, & x \geq 4 \\ -x, & x < 4 \end{cases}$ C) $y = \begin{cases} x, & x \geq 4 \\ x - 8, & x < 4 \end{cases}$ D) $y = \begin{cases} x, & x \geq 4 \\ 8 - x, & x < 4 \end{cases}$

2. $y = |x^2 - x - 20|$ is concave down in the interval:

- A) $(-\infty, \infty)$ B) $(-4, 5)$ C) $(-\infty, -4), (5, \infty)$ D) never

3. A chicken-wing shop has a deal. You must buy 6 wings, costing \$1 apiece. Wings in excess of 6 and up to 12 cost \$0.80 apiece. Any excess of 12 wings costs \$0.65 apiece. If x is the number of wings purchased, which of the following is the piecewise function $f(x)$ describing this.

- A) $\begin{cases} 6x, & x \leq 6 \\ 0.8x, & 6 < x \leq 12 \\ 0.65x, & x > 12 \end{cases}$ B) $\begin{cases} 6x, & x \leq 6 \\ 0.8x + 1.20, & 6 < x \leq 12 \\ 0.65x + 3, & x > 12 \end{cases}$ C) $\begin{cases} 6, & x \leq 6 \\ 0.8x + 1.20, & 6 < x \leq 12 \\ 0.65x + 3, & x > 12 \end{cases}$ D) $\begin{cases} 6, & x \leq 6 \\ 0.8x, & 6 < x \leq 12 \\ 0.65x, & x > 12 \end{cases}$

4. Two companies make large custom signs for parties, both charging by the length L of the sign. Signs Unlimited charges \$100 for the first 5 feet, \$15 a foot for signs between 5 and 10 feet and \$12 a foot for signs over 10 ft. Signs R Us charges \$160 for the first 12 feet and \$20 a foot thereafter. What is the difference in price between the 2 companies for a 20-foot sign?

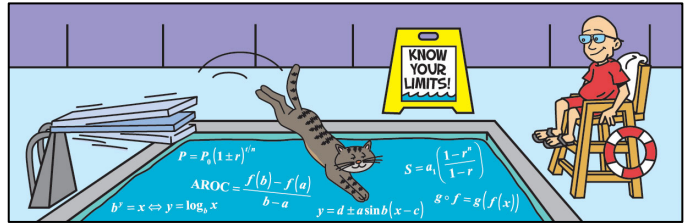
- A) 0 B) \$10 C) \$20 D) \$25

1.7a) Polynomial Modeling

5. On a Sunday, an Emergency Care Facility that is open from 9 AM to 3 PM has 20 people waiting in line at the time they open.
- a. In the first 2 hours, new patients come on the average of one every 5 minutes. In the next 2 hours, new patients come on the average of one every 6 minutes. In the final 2 hours, new patients come in on the average of one every 8 minutes. If t represents the number of minutes since the facility opened, let $N(t)$ be the function predicting the number of patients who come into the facility that day. Determine $N(t)$. **(3)**
- b. 3 patients are seen immediately at 9 AM and after 20 minutes, a patient is seen on average every 5 minutes. After 4 hours, a patient is seen on average every 4 minutes. If t represents the number of minutes since the facility opened, let $S(t)$ be the function predicting the number of patients who are seen by a doctor. Determine $S(t)$. **(3)**
- c. How many people are still waiting to be seen by a doctor at 3 PM? Explain your answer. **(2)**

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AP Precalculus



1.7b) Polynomial Modeling (Calculator)

- If $x + 2y = 49$, what is the maximum value of $V = (x - 1)(y + 2)$?

A) 334.75 B) 336 C) 338 D) 339.25

- A transportation company determines their profit measured in thousands of dollars is based on $P(t) = -0.71t^2 + 11.43t - 0.71$ where t is the number of trains they run per hour during rush hour. They must run at least one train and can run no more than 10. To the nearest thousand dollars, what is the difference between the maximum and minimum profit they can make?

A) \$45,000 B) \$35,000 C) \$8,000 D) \$2,700

- A TV manufacturer has determined that the price to produce t 80-inch TV's is given by $C(t) = 0.008t^3 - 2.5t^2 + 805t + 10000$. Find the number of TV's that should be made to minimize the average cost of producing TV's.

A) 91 B) 176 C) 424 D) 670

- The percentage of a factory's capacity is based on the day of the year. Because of demand, certain days it works to a higher percentage of its capacity than others. Over a certain 365-day period, this percentage is estimated to be $P(t) = 50 + \frac{30000t}{t^2 + 100000}$, $1 \leq t \leq 365$ where $t = 1$ corresponds to January 1. In what month does it reach maximum capacity? Graph below.

A) May B) August C) November D) December

1.7b) Polynomial Modeling

5. At a supermarket, a 2-liter bottle of Pepsi costs \$1.49 and in a week the store sells 2,000 bottles. For every 5 cents that the market reduces the price, it will sell 150 more bottles in a week.

a. Complete the table: **(3)**

# 5-cent increases	1	4	x
Price			
Bottles sold			
Revenue			

1 pt for revenue for each column

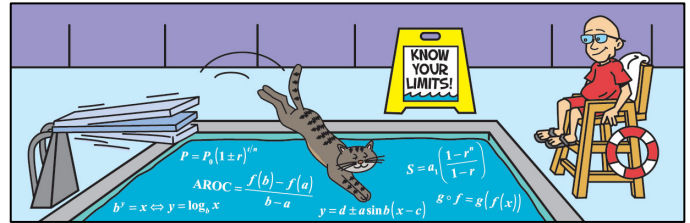
b. The cost to the supermarket per bottle is 25 cents. If x is the number of 5-cent increases, write an expression stating the cost to the market for Pepsi that week. **(1)**

c. Write an expression representing the profit for the supermarket in selling Pepsi that week. **(1)**

d. If the number of 5-cent increases is rounded to an integer, determine the price (nearest dollar) and the corresponding number of bottles that the market should sell to maximize profit. What is that profit? **(3)**

Diving In

AP Precalculus



1.8) Rational Functions (No Calculator)

1. Which of the following curves has one or more vertical asymptotes?

I. $f(x) = \frac{x-1}{x+1}$

II. $f(x) = \frac{x-1}{x^2+1}$

III. $f(x) = \frac{x-1}{x^3-x^2+x-1}$

A) I only

B) II only

C) I and III only

D) I, II, and III

2. Determine the location of the horizontal asymptote to $f(x) = \frac{2x^2 - 8x + 5}{2x^3 - 16}$

A) $y = 0$

B) $y = 1$

C) $y = 2$

D) No horiz. asymptote

3. A math teacher develops a “complication factor” C for a rational function based on points. Points are distributed based on 3 points for each vertical asymptote, 2 points for each zero, and 1 point for each hole in the graph. Find C for $f(x) = \frac{x^3 - 4x^2 - 32x}{64 - x^2}$.

A) 8

B) 10

C) 11

D) 12

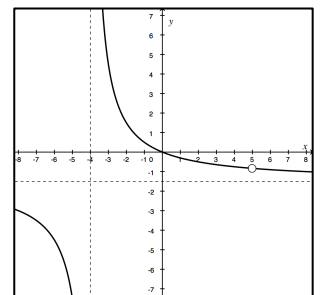
4. The graph to the right can only be:

A) $f(x) = \frac{-15x + 3x^2}{2x^2 - 2x - 20}$

B) $f(x) = \frac{15x - 3x^2}{2x^2 - 2x - 20}$

C) $f(x) = \frac{-3x}{2x+8}$

D) $f(x) = \frac{3x}{2x+8}$



5. In this problem, you are asked to construct functions with certain characteristics.

a. Construct a parabolic function $f(x)$ with zeros at $x = \frac{2}{3}$ and $x = \frac{-3}{2}$. Express the answer in the standard form of a parabola using integer coefficients. **(2)**

b. Let $g(x) = \frac{f(x)}{p(x)}$. $g(x)$ has vertical asymptotes along the y -axis and the line $x = \frac{-1}{2}$. If the degree of the numerator and denominators are equal, determine a possible $g(x)$ eliminating any complex fractions. **(1)**

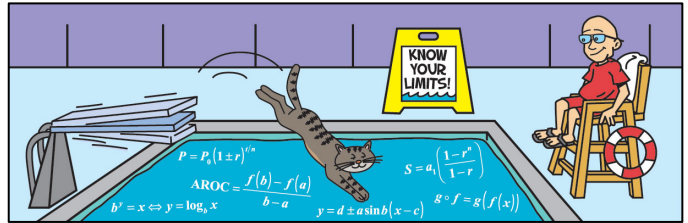
c. If $g(x)$ has one possible horizontal asymptote, determine what it is. If it has more than one possible horizontal asymptote, explain why. **(2)**

d. Without actually calculating it, determine whether $g(-0.2)$ is above or below the x -axis. Show your analysis. **(1)**

e. Suppose the multiplicity of the vertical asymptote along the y -axis is 2. How does that affect answers c and d? **(2)**

Diving In

AP Precalculus



1.9) Rewriting Expressions (No Calculator)

1. $y = \frac{x^2 + 3x - 18}{x + 1}$ has which of the characteristics below?

I. Zeros: $x = -6, x = 3$

II. Vertical Asymptote: $x = -1$

III. Oblique asymptote: $y = x + 4$

A) I and II only

B) I and III only

C) II and III only

D) I, II and III

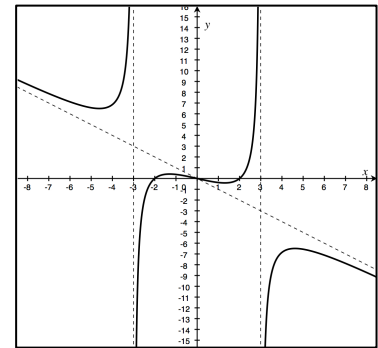
2. The equation of the graph to the right is:

A) $y = \frac{x^3 - 9x}{x^2 - 4}$

B) $y = \frac{4 - x^2}{x^2 - 9}$

C) $y = \frac{x^3 - 4x}{x^2 - 9}$

D) $y = \frac{4x - x^3}{x^2 - 9}$



3. If $\frac{x-8}{x^2+12x+20}$ is written using a partial fraction decomposition in the form of $\frac{A}{x+m} + \frac{B}{x+n}$, find $|A-B|$

A) 1

B) $\frac{7}{2}$

C) 8

D) $\frac{1}{2}$

4. The middle term of $(2x^3 - 3)^4$ is

A) $36x^6$

B) $-36x^6$

C) $216x^6$

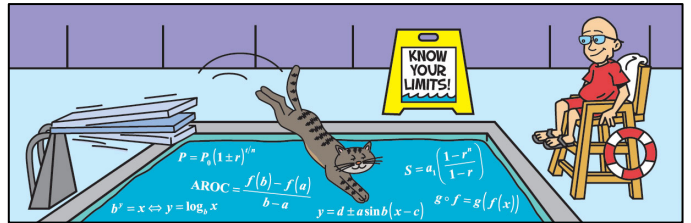
D) $-216x^6$

5. Let $f(x) = \frac{x^3 + 5x^2 - 2x - 24}{x^2 - x - 6}$

- a. Given that $x = -4$ is a zero of $f(x)$, find the other zeros. **(2)**
- b. Determine the location of vertical asymptotes of $f(x)$. **(1)**
- c. Determine the location of the oblique asymptote of $f(x)$. Show how you get your answer. **(3)**
- d. Determine the end behavior of $f(x)$. Express your answer using limit notation. **(1)**
- e. Without actually computing it, show that $f(-2.8) < 0$. **(1)**

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AP Precalculus



1.10) Polynomial/Rat'l Inequalities (No Calculator)

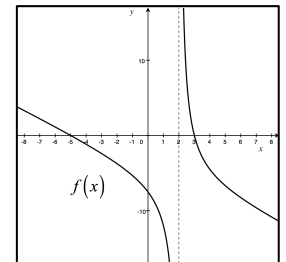
1. Solve $5x^2 + 25x > x^3 + 125$

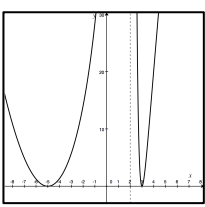
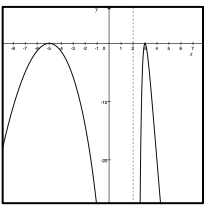
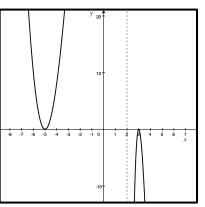
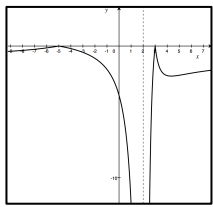
- A) $(-5, \infty)$ B) $(-5, 5), (5, \infty)$ C) $(5, \infty)$ D) $(-\infty, -5), (-5, 5)$

2. Solve $\frac{x-3}{x^3-3x^2-40x} \leq 0$

- A) $(-\infty, -5), (8, \infty)$ B) $(-5, 8)$ C) $(-5, 0), [3, 8]$ D) $(-5, 0), [3, 8)$

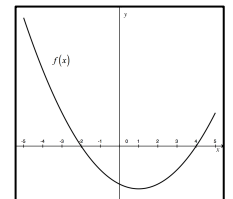
3. The graph of $f(x)$, a rational function whose numerator and denominator are comprised of linear factors, each with multiplicity one, is shown to the right. If $g(x)$ is also a rational function with the same linear factors, but each with multiplicity two, which of the following is the graph of $g(x)$?



- A)  B)  C)  D) 

4. Shown to the right is the graph of $f(x)$ on its domain $[-5, 5]$. Consider $g(x) = x \cdot f(x)$. Find the change in the percentage of values from $f(x) \leq 0$ to $g(x) \leq 0$.

- A) the same B) increased by 10%
C) decreased by 10% D) increased by 20%



1.10) Polynomial/Rational Inequalities

5. Let $f(x) = 10x^4 - 7x^3 - 2x^2 - 10x - 12$

a. Given that i is a zero of $f(x)$, solve $f(x) > 0$ **(3)**

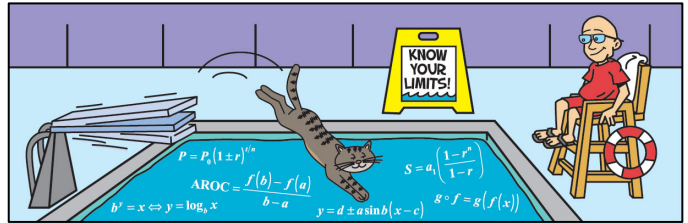
b. Solve $\frac{f(x)}{x} \geq 0$. **(2)**

c. Solve $f(x^2) > 0$. **(2)**

d. How is the solution to $\frac{f(x^2)}{x^2} > 0$ different from answer c? **(1)**

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1.11) Transformations (No Calculator)

1. Given the graph of $f(x)$, the expression that will shift the function 4 units to the left, 3 down and then reflect across the x -axis is

- A) $3 - f(x+4)$ B) $3 - f(x-4)$ C) $-3 - f(x+4)$ D) $-3 - f(x-4)$

2. A cubic polynomial $f(x)$ has a relative maximum at $(-4, 6)$ and a relative minimum at $(2, -8)$. Find the horizontal distance (H) and vertical distance (V) between the relative maximum and minimum of $2f(2x)$.

- A) $H = 12, V = 28$ B) $H = 3, V = 28$ C) $H = 12, V = 7$ D) $H = 3, V = 7$

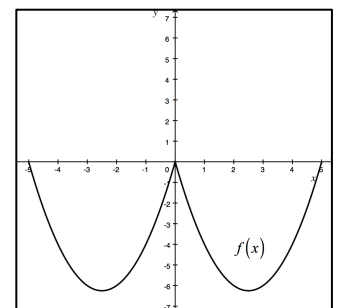
3. Let $f(x)$ be a polynomial with two of its zeros at $x = -6$ and $x = 3$. Find the zeros of $f\left(\frac{1}{2}x + 1\right)$.

- A) $x = -13, x = 3$ B) $x = -16, x = 2$ C) $x = -5, x = -0.5$ D) $x = -14, x = 4$

4. Shown is a graph of $f(x)$ on its domain $[-5, 5]$. Which of the following is true?

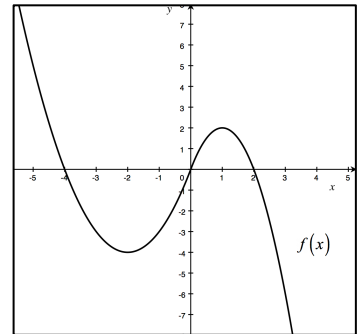
- I. $f(-x) = -f(x)$ II. $-f(x) = |f(x)|$ III. $f(x) = f|x|$

- A) I and II only B) I and III only C) II and III only D) I, II and III



1.11) Transformations

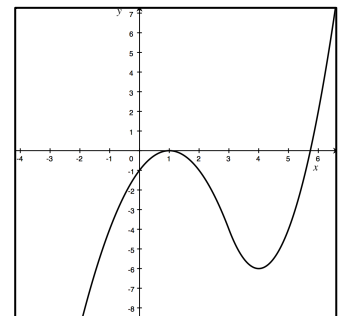
5. Show to the right is a graph of $f(x)$.



a. If $g(x)$ represents a transformation of f such that its zeros are $x = -2$, $x = 0$, and $x = 1$, write an expression in terms of f representing $g(x)$. **(1)**

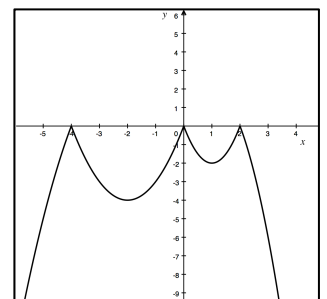
b. If $g(x)$ is to be further transformed such that the relative minimum is $(-1, -2)$ and the relative maximum is $(0.5, 1)$, write an expression in terms of f representing $g(x)$. **(1)**

c. If $h(x)$, whose graph is to the right, is a transformation of f , write an expression for h in terms of f . **(3)**



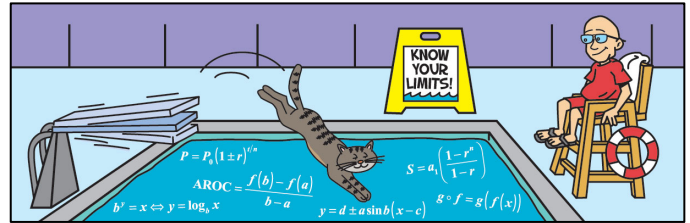
d. What are the points of relative minimum and relative maximum of $f(-x)$. **(2)**

e. If $k(x)$ is a transformation of f appearing to the right, write an expression for $k(x)$. **(1)**



Diving In

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1.12) Rational Functions Modeling Calculator)

- You take a test over 2 days. The first day, you get 26 out of 35 questions correct. The second day's test has an unknown number of questions. To get the final grade in terms of a percentage, you determine the total number of correct answers. What (2 decimal place accuracy) is the range of your grade?

A) $[74\%, 99\%)$ B) $[74\%, 99\%]$ C) $[75\%, 100\%)$ D) $[75\%, 87\%)$

- The function $C(t) = \frac{6.5t}{0.01t^2 + 3.61}$ describes the concentration of a drug, taken orally into the bloodstream. C is measured in micrograms and t in minutes. If the drug is taken at 9:30 AM, at what time is the the maximum amount of the drug in the body?

A) 9:37 AM B) 9:47 AM C) 9:49 AM D) 9:54 AM

- The workers at a company intend to chip in to give a special retiree a \$2,000 gift. The gift is bought and the money collected but 20 people decide not to contribute. If w represents the total number of workers in the company, write an expression to determine how much more than their original share each worker will have to pay. Then use it to determine the value of w if it is determined that each worker has to pay \$16 more.

A) 27 B) 52 C) 55 D) 61

- A cable-service business has a help line. People call in with questions. Some can be answered quickly and others take more time. Let the call-intensity x be the ratio of the average rate of people calling in to the average rate that the calls are answered by a human. The average time that people wait on hold is given by $f(x) = \frac{5x^2}{10 - x}$. Which of the following is true?

I. If the call intensity is 4, expect to wait over 15 minutes. II. Theoretically, you can be on hold forever.

A) I only B) II only C) I and II D) Neither

1.12) Rational Function Modeling

5. An item pays for itself if buying it will eventually save you money. For instance, installing security cameras is expensive but if installing them will prevent losses from stealing, the camera will pay for themselves.

Mr. Jackson purchased a large freezer unit to hold a great deal of frozen foods, notably chicken. Chicken costs \$4.50 a pound but if he buys in bulk, he only pays \$2.50 a pound. However, research tells him that storing the chicken for long periods of time will cause freezer burn, making the chicken tough to eat. He contemplates purchasing a vacuum sealer which takes the air from the package, prolonging its shelf life. He reasons that by spending the \$150 on the sealer, it will eventually pay for itself.

- a. If he purchases x pounds of chicken at the reduced price as well as the vacuum sealer, how much will he initially spend? **(1)**
- b. Write an equation to determine the average cost per pound of chicken A after purchasing the vacuum sealer. Identify and explain the role of the vertical and horizontal asymptote in this function. **(3)**
- c. Find the average rate of change of A from $x = 20$ to $x = 25$. Express your answer in the proper units. **(2)**
- d. Find the approximate instantaneous rate of change in A when $x = 20$ pounds. Express your answer in the proper units. **(1)**
- e. How many pounds of chicken must he buy for the cost of the vacuum sealer to pay for itself? **(1)**