

AP Calculus AB Summer Assignment

Cape Henlopen High School

Teacher: Mrs. Jacquelyn O'Brien

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Dear AB Calculus Student,

Congratulations on your wisdom in taking the AB course! I know you will find it rewarding and a great way to spend next year. This course is primarily concerned with developing your understanding of the concepts of calculus and providing experience with its methods and applications. The course emphasizes a multi-representational approach to calculus, with concepts, results, and problems being expressed graphically, numerically, analytically, and verbally. To be successful in this course you need the proper foundation (i.e. knowledge of algebra, geometry, trigonometry, analytic geometry, and elementary functions).

You **MUST** be very familiar with the basic families of functions, and all their representations, to be successful in your study of calculus. The concept of functions underlies everything that calculus considers. You will also need to be able to carry out certain computational tasks (i.e. algebra skills) with efficiency and accuracy. **Most problems are solved without the use of a calculator or Desmos. Do not use either on the summer packet.**

Please do not rely on AI when completing Practice Assignment (including this summer assignment).

Relying heavily on AI in the math classroom can hinder student learning and critical thinking. AI can solve problems quickly, but this can prevent students from developing their own understanding of the concepts and problem-solving processes, potentially leading to a lack of genuine understanding.

This packet is intended to prepare you for a successful year AP Calculus AB and should be taken seriously.

I am providing the graphs of the basic parent function. Make sure you know them and understand basic features of each. Domain, Range, Asymptotes and End Behaviors. **A short matching quiz will be given on the first day of class.**

As a calculus student you must know your unit circle, which I am including as well. In Calculus we do all trig work in radians. A blank copy of the Unit Circle is also included. Make sure you can fill it out in under 15 minutes. **You will be taking a quiz on the Unit Circle the second day of class. Your grade will be either 100 or zero.** You may take the quiz up to three times, but not on the same day.

You will have the opportunity to ask questions on the first day of school regarding any questions on the summer packet. A 45-minute quiz will be given on the third day of school with questions from the summer assignment. **Please let me stress not to use math AI tools, as it will not be of benefit when it is time to take the quiz. Phones will be put in a caddy and iPad put away. Quiz will be non-calculator.**

I look forward to working with each of you. AB Calculus will be challenging but I know we will have a great year of Math learning.

**SUMMER ASSIGNMENT WILL NOT BE COLLECTED OR GRADED.
IT SERVES AS A GUIDE FOR THE ASSESSMENTS GIVEN THE FIRST 3 DAYS OF SCHOOL.**

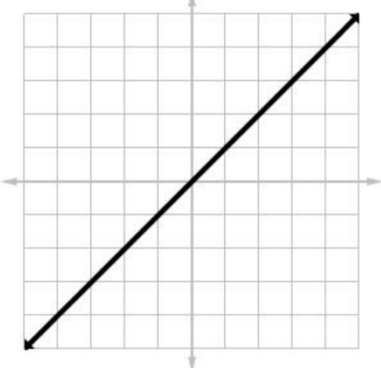
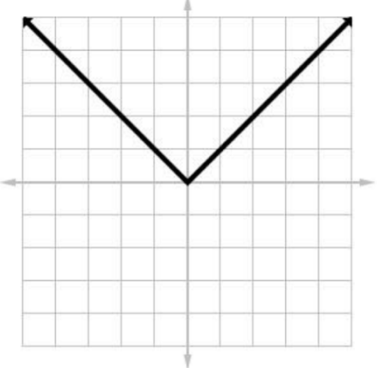
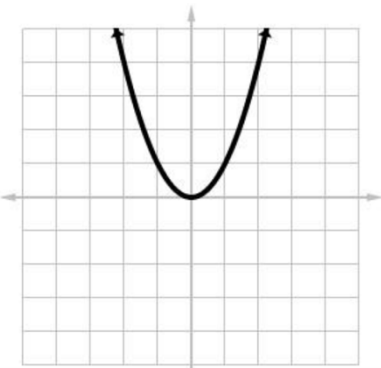
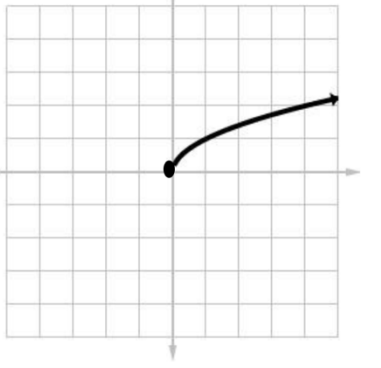
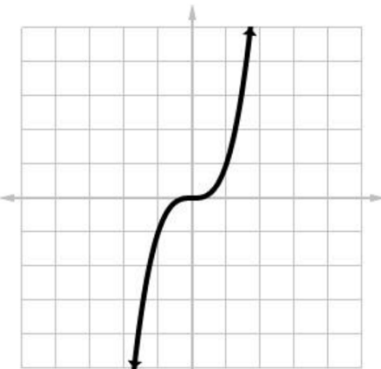
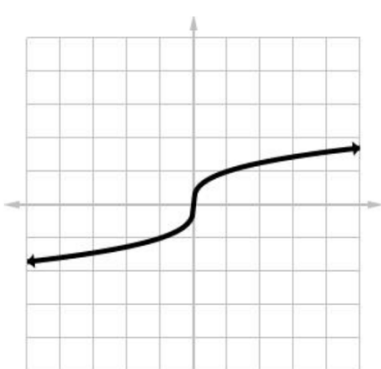
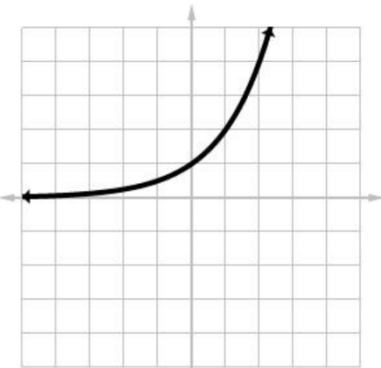
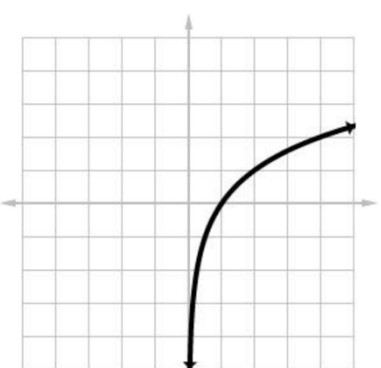
Have a restful summer and be ready to talk math again in August.

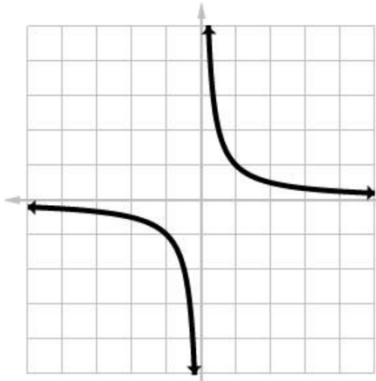
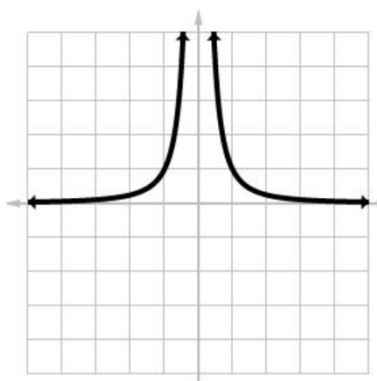
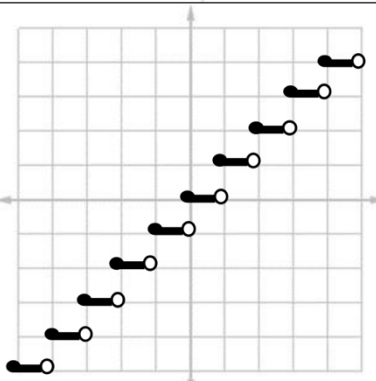
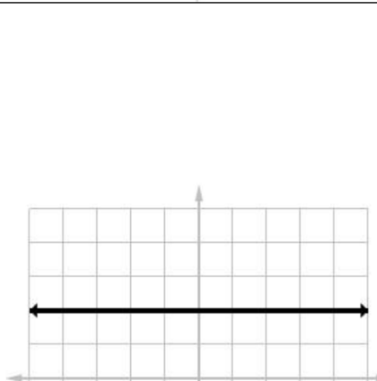
Sincerely,

Mrs. O'Brien

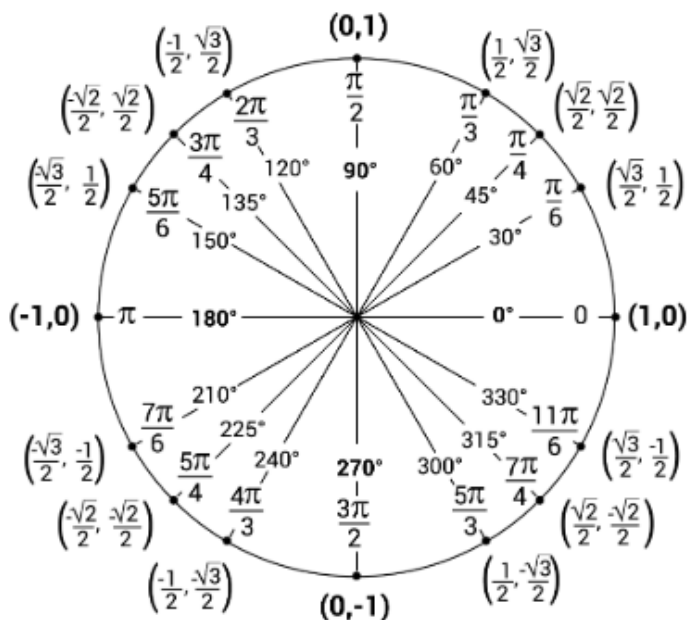
Jacquelyn.Obrien@cape.k12.de.us

10 Basic Parent Functions

Parent Function	Graph		Graph
$y=x$ Linear , Odd Domain: $(-\infty, \infty)$ Range: $(-\infty, \infty)$ End Behavior: $x \rightarrow -\infty, y \rightarrow -\infty$ $x \rightarrow \infty, y \rightarrow \infty$ Critical points: $(-1, -1), (0, 0), (1, 1)$		$y = x $ Absolute Value , Even Domain: $(-\infty, \infty)$ Range: $[0, \infty)$ End Behavior: $x \rightarrow -\infty, y \rightarrow \infty$ $x \rightarrow \infty, y \rightarrow \infty$ Critical points: $(-1, 1), (0, 0), (1, 1)$	
$y=x^2$ Quadratic , Even Domain: $(-\infty, \infty)$ Range: $[0, \infty)$ End Behavior: $x \rightarrow -\infty, y \rightarrow \infty$ $x \rightarrow \infty, y \rightarrow \infty$ Critical points: $(-1, 1), (0, 0), (1, 1)$		$y = \sqrt{x}$ Radical , Neither (Square Root) Domain: $[0, \infty)$ Range: $[0, \infty)$ End Behavior: $x \rightarrow 0, y \rightarrow 0$ $x \rightarrow \infty, y \rightarrow \infty$ Critical points: $(0, 0), (1, 1), (4, 2)$	
$y=x^3$ Cubic , Odd Domain: $(-\infty, \infty)$ Range: $(-\infty, \infty)$ End Behavior: $x \rightarrow -\infty, y \rightarrow -\infty$ $x \rightarrow \infty, y \rightarrow \infty$ Critical points: $(-1, -1), (0, 0), (1, 1)$		$y = \sqrt[3]{x}$ Cube Root , Odd Domain: $(-\infty, \infty)$ Range: $(-\infty, \infty)$ End Behavior: $x \rightarrow -\infty, y \rightarrow -\infty$ $x \rightarrow \infty, y \rightarrow \infty$ Critical points: $(-1, -1), (0, 0), (1, 1)$	
$y = b^x, b > 1$ $(y = 2^x)$ Exponential , Neither Domain: $(-\infty, \infty)$ Range: $(0, \infty)$ End Behavior: $x \rightarrow -\infty, y \rightarrow 0$ $x \rightarrow \infty, y \rightarrow \infty$ Critical points: $(-1, 1/2), (0, 1), (1, 2)$ Asymptote: $y = 0$		$y = \log_b x, b > 1$ $(y = \log_2 x)$ Log , Neither Domain: $(0, \infty)$ Range: $(-\infty, \infty)$ End Behavior: $x \rightarrow 0^+, y \rightarrow -\infty$ $x \rightarrow \infty, y \rightarrow \infty$ Critical points: $(1/b, -1), (1, 0), (b, 1)$ Asymptote: $x = 0$	

$y = \frac{1}{x}$ Rational, Odd (Inverse) Domain: $(-\infty, 0) \cup (0, \infty)$ Range: $(-\infty, 0) \cup (0, \infty)$ End Behavior: $x \rightarrow -\infty, y \rightarrow 0$ $x \rightarrow \infty, y \rightarrow 0$ Critical points: $(-1, -1), (1, 1)$ Asymptotes: $y = 0, x = 0$		$y = \frac{1}{x^2}$ Rational, Even (Inverse Squared) Domain: $(-\infty, 0) \cup (0, \infty)$ Range: $(0, \infty)$ End Behavior: $x \rightarrow -\infty, y \rightarrow 0$ $x \rightarrow \infty, y \rightarrow 0$ Critical points: $(-1, 1), (1, 1)$ Asymptotes: $x = 0, y = 0$	
$y = \text{int}(x) = \llbracket x \rrbracket$ Greatest Integer, Neither Domain: $(-\infty, \infty)$ Range: $\{y: y \in \mathbb{Z}\}$ ($\mathbb{Z}$ = integers) End Behavior: $x \rightarrow -\infty, y \rightarrow -\infty$ $x \rightarrow \infty, y \rightarrow \infty$ Critical points: $x: [-1, 0) \quad y: -1$ $x: [0, 1) \quad y: 0$ $x: [1, 2) \quad y: 1$		$y = C$ ($y = 2$) Constant, Even Domain: $(-\infty, \infty)$ Range: $\{y: y = C\}$ End Behavior: $x \rightarrow -\infty, y \rightarrow C$ $x \rightarrow \infty, y \rightarrow C$ Critical points: $(-1, C), (0, C), (1, C)$	

The Unit Circle

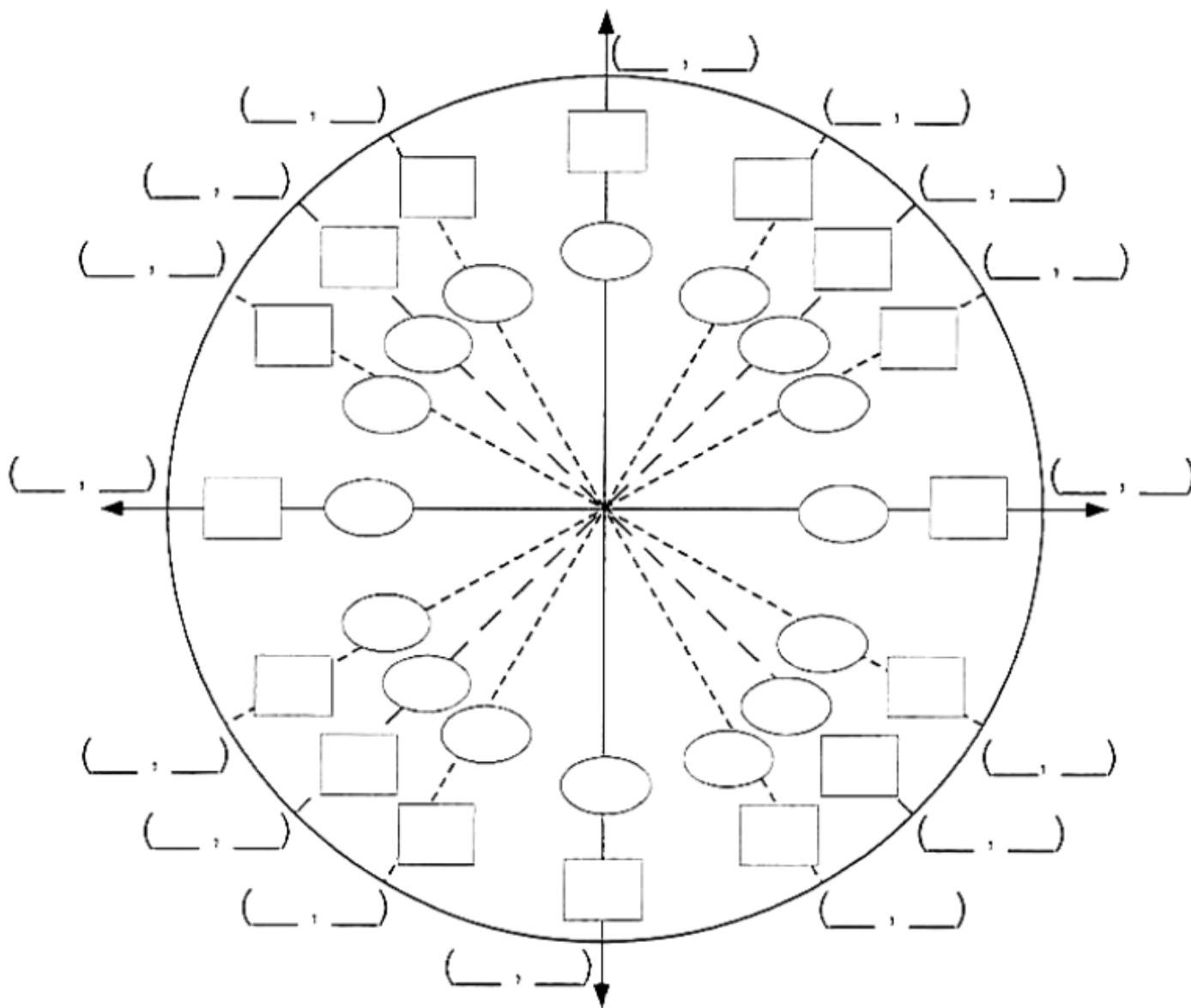


Video Link: Understanding the Unit Circle: <https://www.youtube.com/watch?v=UgE05lwjrJQ>

Video Link: An Easy Way to Memorize the Unit Circle: <https://www.youtube.com/watch?v=ao4EjzNWmK8>

Here is a blank Unit Circle: Make sure you can fill this out in 15 minutes or under. Know your radian measures.

THE UNIT CIRCLE



The summer assignment should be completed without the use of a calculator.

1. With the given information write the equation of a line in Point-Slope format. $y - y_1 = m(x - x_1)$

- a. Passing through the points $(-2, 5)$ and $(3, -8)$ b. Passing through the point $(2, 8)$ and parallel to $y = \frac{5}{6}x - 1$.

2. Write the equation of the horizontal and vertical lines passing through the point $(-8, 9)$.

3. Factor each polynomial completely.

- a. $x^2 + 7x - 8$ b. $x^2 - 16x + 14$ c. $4x^2 - 4x - 3$ d. $4x^2 - 1$
- e. $x^2 - 6x + 9$ f. $4n^2 + 32n + 64$ g. $-x^2 - 13x - 30$ h. $3n^4 + 9n^3 - 12n^2$

4. Solve each equation. **Answers must be exact. No decimals.**

a. $\frac{1}{4} + \frac{2}{3}(4x + 9) = 0$ b. $121x^2 = 49$ c. $x^2 - 9x = -8$

d. $5x^2 + 14x + 14 = 2 - 2x$ e. $e^{2x} = 5$ f. $\ln(4 + x) = 3$

5. Evaluate $h(x) = \begin{cases} x^2 - 3x + 7, & x < -4 \\ 2x - 7, & x = 7 \\ 8, & x \neq 7 \text{ and } x \geq -4 \end{cases}$ a. $h(7)$ b. $h(-4)$ c. $h(0)$ d. $h(-5)$

6. Simplify the expression by rationalizing the denominator. $\frac{2}{\sqrt{3}+\sqrt{2}}$

7. Simplify completely. Answers should be written as a single fraction. State any restrictions on the domain.

a. $\frac{x^2-4}{x^2+5x+6}$

b. $\frac{1}{2} + \frac{1}{2+h}$

c. $\frac{\frac{1}{x-6}}{\frac{1}{x^2-36}}$

8. Find the inverse of each function.

a. $f(x) = 2x + 1$

b. $f(x) = \frac{x^2}{3}$

9. Given $f(x) = x^2 - 2x + 5$ find the following.

a. $f(-2)$

b. $f(x+2)$

c. $f(x+h)$

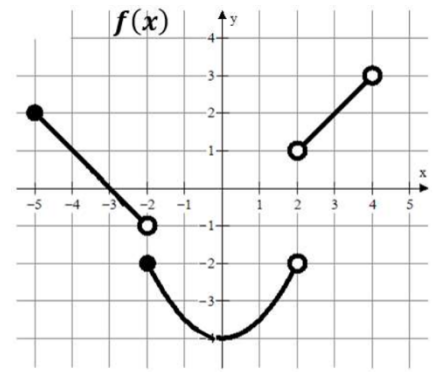
10. Given $f(x) = 3x + 2$ and $g(x) = 2x^2 - 1$, evaluate each composite function.

a. $f(g(4))$

b. $g(f(2))$

c. $f(f(1))$

11. Use the graph of $f(x)$ to answer the following.



a. $f(0)$

b. $f(4)$

c. $f(-1)$

d. $f(-2)$

e. $f(2)$

f. $f(3)$

g. $f(x) = 2$ when $x = ?$

12. Evaluate:

a. $36^{\frac{3}{2}}$

b. $4^{\frac{5}{2}}$

c. $\left(\frac{1}{9}\right)^{-3}$

d. $(16)^{\frac{3}{4}}$

13. Convert to exponential form:

a. $\sqrt[8]{x^3}$

b. $\sqrt{7^5}$

14. Convert to radical form:

a. $6^{\frac{3}{7}}$

b. $m^{\frac{9}{2}}$

15. Simplify using the properties of exponents. **Answers should not contain negative exponents.**

a. $\frac{25a^3b^5c}{5a^2b^2c}$

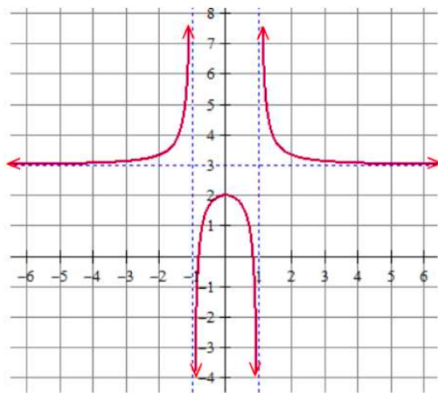
b. $5^3 \cdot 5^6 \cdot 5 \cdot 5^0$

c. $(x^{-2}x^{-3})^4$

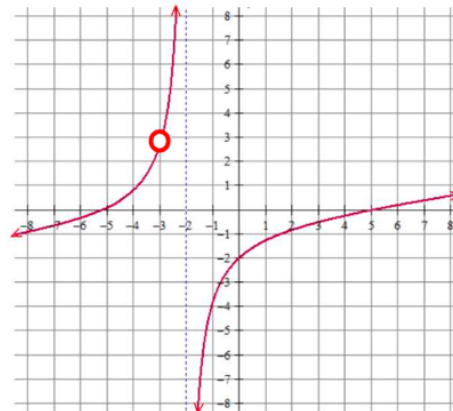
d. $4n^4 \cdot 2n^{-3}$

16. Find the domain and range in interval notation. Find all horizontal and vertical asymptotes.

a.



b.



Domain:

Range:

Domain:

Range

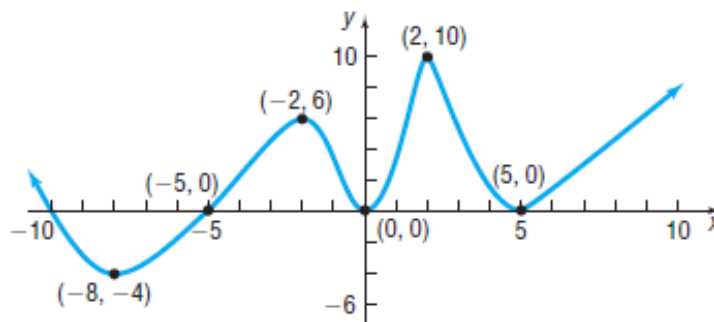
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17. Use each graph to answer the questions.



x-intercept(s): _____ y-intercept: _____ Is the graph a function? _____

Domain: _____ Range: _____ Find $f(-10)$ _____

Where does $f(x) = 0$? _____ How many times does the line $y = 1$ intersect the graph? _____

On which interval is $f(x) < 0$? _____ On which interval is $f(x) > 0$? _____

Absolute maximum: _____ Absolute minimum: _____ Local Maximum(s): _____ Local minimum(s): _____

On which interval is the graph increasing? _____ On which interval is the graph decreasing? _____

18. Find each of the following trig functions in RADIANS. In Calculus we never use degrees.

a. $\sin \frac{\pi}{6}$ b. $\cos \frac{\pi}{4}$ c. $\sin 2\pi$ d. $\sec \frac{\pi}{2}$ e. $\cos \frac{\pi}{6}$

f. $\tan \pi$ g. $\sin \frac{\pi}{3}$ h. $\csc \frac{\pi}{2}$ i. $\tan \frac{\pi}{4}$ j. $\cos \frac{\pi}{3}$

19. Solve the following trig equation where $0 \leq x \leq 2\pi$.

a. $\sin x = -\frac{1}{2}$ b. $\cos x = \frac{\sqrt{2}}{2}$ c. $\tan x = 0$ d. $2\cos x = -1$

e. $4\cos^2 x - 3 = 0$ f. $\tan^2 x + \tan x = 0$ g. $\sin x - \cos x = 0$ h. $\sin^2 x = \frac{1}{2}$