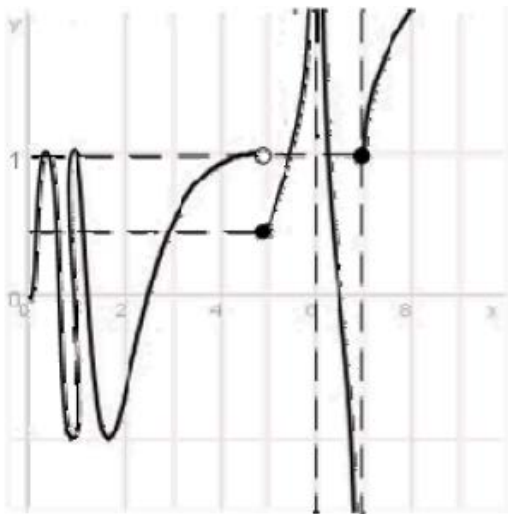


- Find the domain and the range of the function $y = \frac{1}{1 + \sqrt{1 - x^2}}$.
- Given $f(x) = \sqrt{\frac{x}{1-x}}$ and $g(x) = x^2$. Calculate the composite functions $f \circ g$ and $g \circ f$ and determine their domains.
- Find $\cos \theta$, $\sec \theta$ and $\tan \theta$ if $\sin \theta = \frac{1}{3}$ and θ is obtuse ($> \pi/2$).
- Determine $\csc(\tan^{-1} \sqrt{1+x^2})$.
- The volume of a sphere of radius R is $V = \frac{4\pi R^3}{3}$. What is the average rate of change of the volume when the radius increases from $R = 1$ to $R = 3$?
- Determine the one-sided limits at $C = 0, 5, 6, 7$ of the function $f(x)$ shown in the figure and state whether the limit exists at these points (if a limit is infinite, write ∞ or $-\infty$).



- Determine the points where the function is not continuous and state the type of discontinuity: removable, jump, infinite, or none of these.

A) $\frac{x^2 + 2x - 8}{|x - 2|}$

B) $\frac{x}{[x]}, x \geq 1$

C) $\frac{(x^3 - 3x + 2)\sin 2x}{x}$

8. Evaluate the limit or state that it does not exist (you must have evidence and show work to get any credit).

A) $\lim_{x \rightarrow 2} \frac{x^4 - x^2 - 12}{x - 2}$

B) $\lim_{x \rightarrow 1} \frac{\sqrt{x^2 + 1} - \sqrt{x + 1}}{x^2 + x - 2}$

C) $\lim_{x \rightarrow 2} \frac{\sqrt{x^2 - 4x + 4}}{x - 2}$

9. Given a function f , what does the quantity $\frac{f(3) - f(1)}{2}$ represent?

10. If $\lim_{h \rightarrow 0} \frac{f(3+h) - f(3)}{h} = \lim_{h \rightarrow 0} \frac{f(4+h) - f(4)}{h} = 3.5$ then what do you know regarding the derivative of f ?

11. Let f be a function satisfying $f'(x) = 4x^4 + f^2(x) + 2^x$. Which of the following statements must be true?

A) $f'(0) = 1$

B) $f(x) > 0$ for all x

C) The tangent line to the graph of f at every point has a positive slope.

D) f is not differentiable at $x = 0$

12. Find coordinates of all points on the curve $y = \sqrt{x} - .25x^2 + 4$ at which the slope of the tangent line is horizontal. What is the equation of the tangent line(s)?

13. Calculate the derivatives of the following functions:

A) $g(x) = \frac{\sqrt{x} + e^x}{4x^2 - 3x}$

B) $h(x) = (e^x + 5) \left(\frac{x^2 + 4}{x - 1} \right)$

Bonus: Use the limit definition of derivative together with properties of limits to prove the quotient rule.