

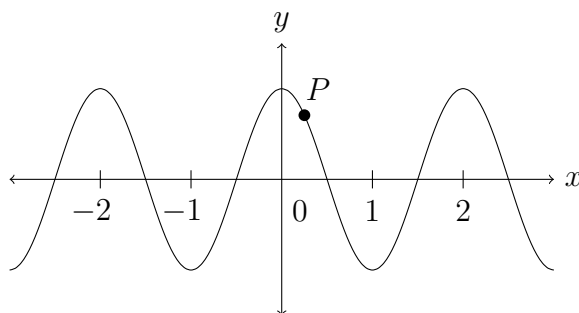
Name: _____

Discussion Section: _____

Solutions should show all of your work, not just a single final answer.

2.1: The Tangent and Velocity Problems

1. The point $P = (1/4, 1/\sqrt{2})$ lies on the curve $y = \cos(\pi x)$ where x is in **radians**, as shown below.



- (a) If $Q = (x, \cos(\pi x))$ then use your calculator to find the slope of the secant line PQ , rounded to four digits after the decimal point, for the following values of x :
- | | |
|---------------|--------------|
| (i) 0.24, | (iv) 0.26, |
| (ii) 0.249, | (v) 0.251, |
| (iii) 0.2499, | (vi) 0.2501. |
- (b) Using the results of part(a), estimate the value of the slope of the tangent line to the curve at $(1/4, 1/\sqrt{2})$ to three digits after the decimal point.

- (c) Using the estimated slope from part(b), what is an estimate for the equation of the tangent line to the graph of $y = \cos(\pi x)$ at $(1/4, 1/\sqrt{2})$? Write the final answer in the form $y = mx + b$ where m and b are each rounded to three digits after the decimal point.

2. The displacement of an object on a line, in meters, is $s = 1 + 2t + \frac{1}{4}t^2$, where t is in seconds.

- (a) Find the average velocity in m/sec over each of the following time periods. For parts (i) through (v), *round your answer to three digits after the decimal point*. In part (vi), h is a nonzero variable and the final answer is in terms of h .

(i) $[1, 1.5]$

(ii) $[1, 1.1]$

(iii) $[1, 1.01]$

(iv) $[\cdot 9, 1]$

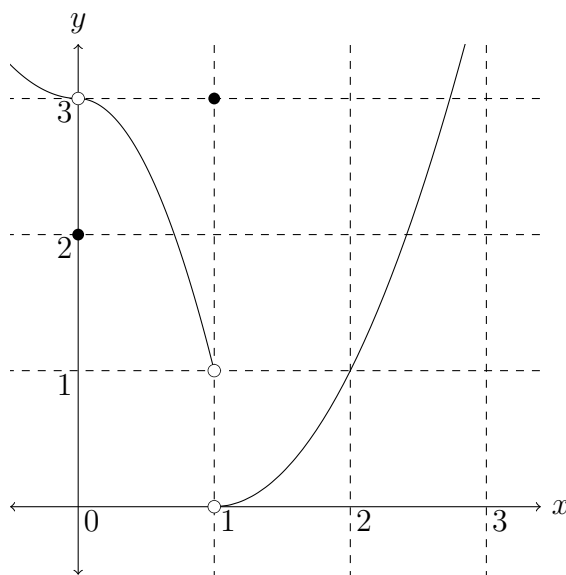
(v) $[\cdot 99, 1]$

(vi) $[1, 1 + h]$ (for $h > 0$) or $[1 + h, 1]$ (for $h < 0$)

- (b) Use the work in part a to estimate the instantaneous velocity of the object at time $t = 1$, in m/sec.

2.2: The Limit of a Function

3. The graph of $y = f(x)$ is below. Use it to compute each limit or explain why it doesn't exist.



(a) $\lim_{x \rightarrow 0^-} f(x)$

(b) $\lim_{x \rightarrow 1^-} f(x)$

(c) $\lim_{x \rightarrow 2^-} f(x)$

(d) $\lim_{x \rightarrow 0^+} f(x)$

(e) $\lim_{x \rightarrow 1^+} f(x)$

(f) $\lim_{x \rightarrow 2^+} f(x)$

(g) $\lim_{x \rightarrow 0} f(x)$

(h) $\lim_{x \rightarrow 1} f(x)$

(i) $\lim_{x \rightarrow 2} f(x)$

(j) $f(0)$

(k) $f(1)$

(l) $f(2)$

4. Determine whether the following limits are finite, ∞ , or $-\infty$. If the limit does not exist for any other reason, write DNE with a justification.

(a) $\lim_{x \rightarrow 1} \frac{\sqrt{x}}{2(x-1)^2}$

(b) $\lim_{x \rightarrow 1^+} \frac{x-2}{x-1}$

(c) $\lim_{x \rightarrow 0} \frac{1}{x} - \frac{1}{x^2}$

5. T/F (with justification) The line $x = 1$ is a vertical asymptote of the graph of $y = \frac{x^2 - 1}{x^2 - 2x + 1}$.

6. T/F (with justification) The line $x = 1$ is a vertical asymptote of the graph of $y = \frac{x^2 - 2x + 1}{x^2 - 1}$.