

1. [8] TRUE/FALSE: Let f and g be functions. Circle T in each of the following cases if the statement is *always* true. Otherwise, circle F.

T F $x + \frac{1}{x} = \frac{x+1}{x}$

T F $\frac{1}{x^2} = x^{\frac{1}{2}}$

T F If $\lim_{h \rightarrow 0} g(x) = 0$ then $\lim_{h \rightarrow 0} \frac{f(x)}{g(x)}$ does not exist.

T F If f is a continuous function, $f(0) = 2$, and $f(4) = -2$, then the graph of f has an x -intercept between 0 and 4.

T F If f is continuous at a , then f is differentiable at a .

T F $(e^x)' = xe^{x-1}$.

T F $\frac{d}{dx}(\sin(x)) = \cos(x)$.

T F $x^3 = 3x^2$

Show *all* your work (numerically, algebraically, or geometrically) for the following problems. Supporting work is needed to earn credit.

2. [4] Let f be a function. Explain what $f'(2)$ is to a fifth grader.

3. The following graph represents the distance d (in inches) an ant is from Dr. Vanderpool after x seconds.

(a) [1] How far is the ant from Dr. Vanderpool initially?

(b) [6] Estimate the following, if possible:
 (9/27Lecurer, LimitActivity #2, WebHW2 #5,
 PracticeExam#3, DerivativeActivity#1)

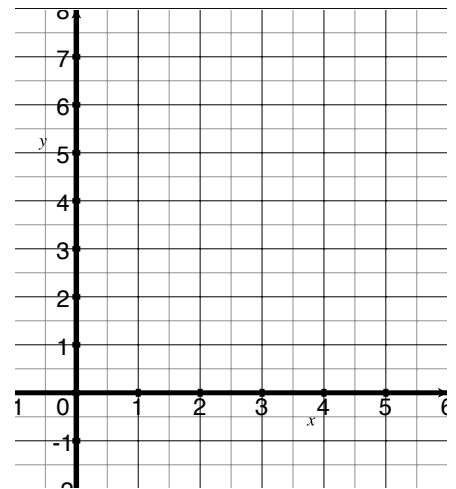
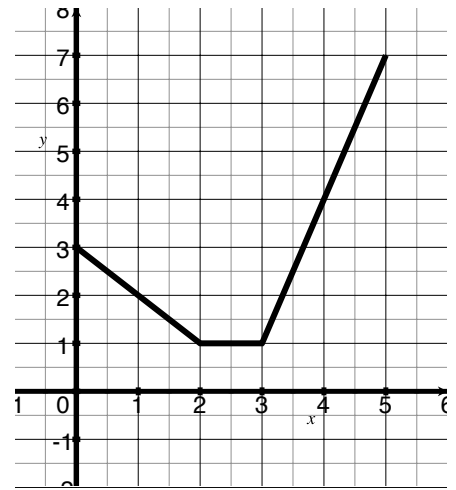
$$d(2)$$

$$\lim_{x \rightarrow 1} d(x)$$

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

$$\lim_{x \rightarrow 3} (2d(x) - 6)$$

$$\frac{d}{dx} d \Big|_{x=4}$$



4. [3] (§3.2 #104) On the blank axis sketch the graph of the ant's velocity.

5. [6] Find the limit if it exists, or explain why it does not exist.

(§2.4 #114)

$$\lim_{x \rightarrow 1^+} \ln(x - 1)$$

(LimitLawActivity #1)

$$\lim_{x \rightarrow \pi} \frac{2}{x - 3} + \cos(x)$$

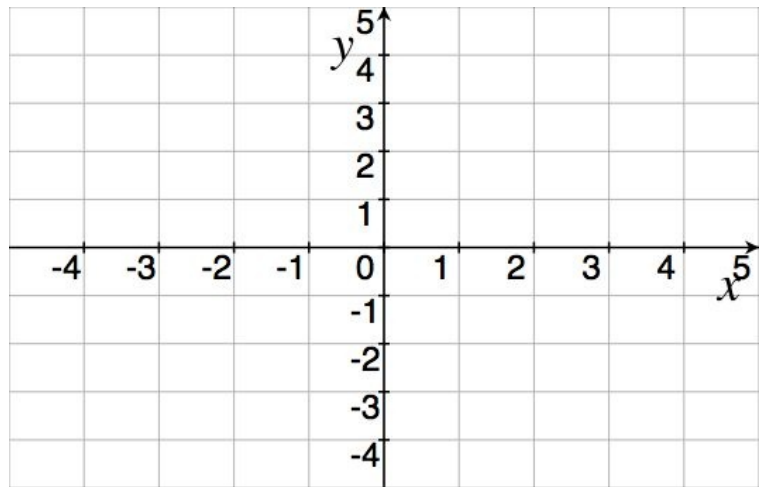
6. [5] (Quiz2 #2) Draw a graph for a function $\alpha(x)$, that satisfies all of the following:

(a) $\lim_{x \rightarrow \infty} \alpha(x) = 2$,

(b) α is not continuous at $x = -3$,

(c) $\alpha(-3) = 4$

(d) $\alpha'(0)$ is negative



7. [3] (2016Exam1 #2) If the tangent line to $y = f(x)$ at $(1, 0)$ passes through the point $(-1, -3)$. Find the following:

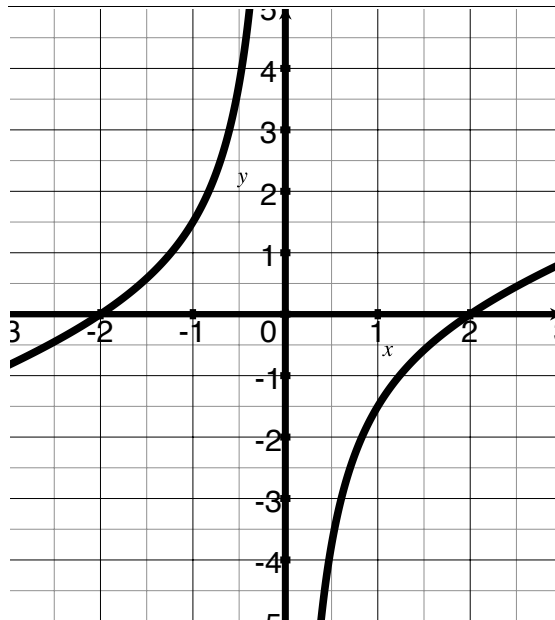
(a) $f(1)$

(b) $f'(1)$

8. Consider $g(x) = \frac{\frac{1}{2}x^2 - 2}{x}$
graphed to the right.

(a) [4] (WebHW6 #7)

Find $\frac{dg}{dx}$



(b) [2] (Quiz2 #3) Find $g'(1)$

(c) [3] (Poly&ExpActivity #4) Find the equation of the line tangent to g when $x = 1$.

9. Choose *ONE* of the following. Clearly identify which of the two you are answering and what work you want to be considered for credit.

No, doing both questions will not earn you extra credit.

- (a) (2013WinterExam1) Under certain assumptions the velocity $v(t)$ of a falling raindrop at time t is:

$$v(t) = v^*(1 - e^{-\frac{gt}{v^*}})$$

where g is the acceleration due to gravity (9.8 m/s^2).

- i. [3] Find $\lim_{t \rightarrow \infty} v(t)$.
 - ii. [2] Interpret the answer given in (i) as a scientist and explain what v^* is in everyday language.
- (b) (WordProblems #1) Test makers use item response functions $P(x)$ to determine the difficulty and effectiveness of a given test question. The variable x is the ability of a test taker and $P(x)$ is the probability that the test taker gets the problem correct. By convention we let an “average ability” correspond with $x = 0$. Thus $P(0) = .75$ means that a person with average ability has a 75% chance of getting the question correct.

- i. [2] Assume the question is multiple choice with 3 answers, find $\lim_{x \rightarrow -\infty} P(x)$. Justify yourself.

- ii. [3] Identify which graph below is a better exam question. Justify your choice.

