

SCORE: \_\_\_\_ / 20 POINTS

The graph of a function  $f$  is shown on the right. State the values of the following expressions, if they exist. Write DNE where appropriate.

SCORE: \_\_\_\_ / 4 POINTS

[a]  $f(-3)$  2

[b]  $\lim_{x \rightarrow -3^-} f(x)$  1

[c]  $\lim_{x \rightarrow -3} f(x)$  DNE

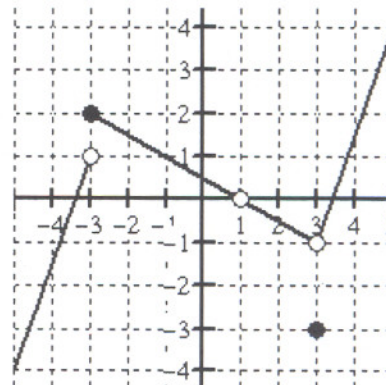
[d]  $f(3)$  -3

[e]  $\lim_{x \rightarrow 3} f(x)$  -1

[f]  $\lim_{x \rightarrow -1} f(x)$  1

[g]  $f(1)$  DNE

[h]  $\lim_{x \rightarrow 1} f(x)$  0



Some values for a function  $f$  are given in the table below.

SCORE: \_\_\_\_ / 3 POINTS

Estimate the slope of the tangent line to  $y = f(x)$  at  $x = 3$  by averaging the slope of 2 appropriate secant lines.

Show the calculations that lead to your answers.

$x$	1	3	5	7	9	11
$f(x)$	-2	2	6	4	12	8

$$\frac{2 - (-2)}{3 - 1} = 2$$

$$\frac{6 - 2}{5 - 3} = 2$$

$$\frac{2 + 2}{2} = 2$$

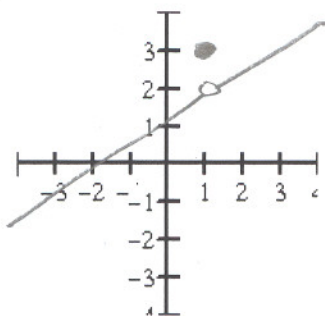
Sketch the graph of a function  $f$  such that

SCORE: \_\_\_ / 3 POINTS

$f(1)$  exists,

$\lim_{x \rightarrow 1} f(x)$  exists and

$\lim_{x \rightarrow 1} f(x) \neq f(1)$ .



The position of an object travelling along a straight line is given by  $s(t) = t^3 + t$ .

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Find the average velocity of the object for the time period beginning when  $t = 3$  and lasting 0.2 second.

Show the calculations that lead to your answers.

$$\frac{s(3.2) - s(3)}{3.2 - 3} = \frac{35.968 - 30}{0.2} = 29.84$$

The point  $P(2, 4)$  lies on the curve  $y = \sqrt{x^2 + 12}$ .

$$\frac{\sqrt{x^2 + 12} - 4}{x - 2}$$

SCORE: \_\_\_ / 7 POINTS

- (a) If  $Q$  is the point  $(x, \sqrt{x^2 + 12})$ , use your calculator to find the slope of the secant line  $PQ$  (correct to three decimal places) for the following values of  $x$ :

$x$	1.5	1.9	1.99	1.999	2.001	2.01	2.1	2.5
slope of secant line	0.450	0.491	0.499	0.500	0.500	0.501	0.509	0.544

- (b) Using the results of part (a), guess the value of the slope of the tangent line to the curve at  $P(2, 4)$ .

$$\frac{1}{2}$$

- (c) Using the slope from part (b), find an equation of the tangent line to the curve at  $P(2, 4)$ .

$$y - 4 = \frac{1}{2}(x - 2)$$

OR

$$y = 4 + \frac{1}{2}(x - 2) \text{ or } y = \frac{1}{2}x + 3$$