Section 2.2

1.

The graph is that of the line $y = -2x + 2$. The slope, and hence the derivative, is -2. See Figure 2.11.

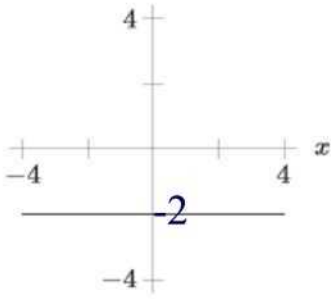
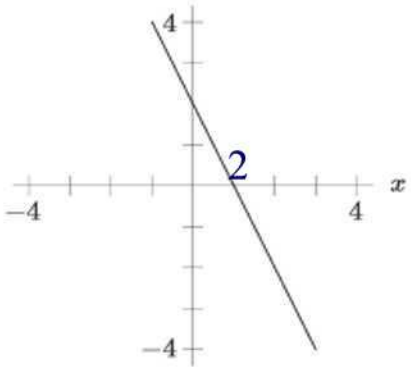
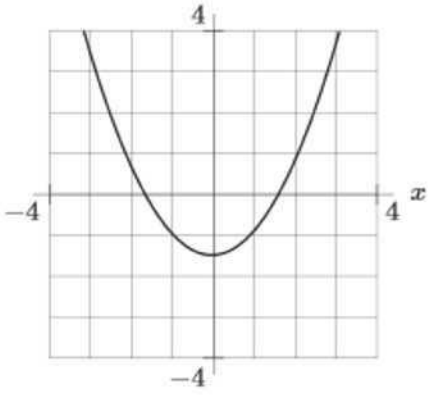


Figure 2.11

2.



3.



8.

From the graph, we estimate the derivative at any point by placing a straight edge so that it forms the tangent line at that point, and then using the grid to estimate the slope of the tangent line.

$f'(1) = \frac{-2}{0.5} = -4$ $\quad f'(3) = 0$ $\quad f'(5) = \frac{2}{0.5} = 4$

$f'(2) = \frac{-1}{0.75} = -1.33$ $\quad f'(4) = \frac{1}{0.75} = 1.33$

10. We have

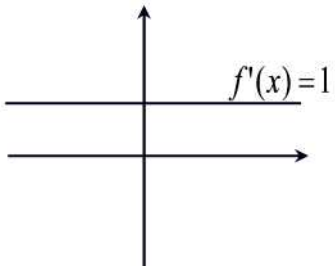
$$
\begin{aligned}
f'(0) &\approx \frac{f(5)-f(0)}{5-0} = \frac{70-100}{5} = -6 \\
f'(5) &\approx \frac{1}{2}\left(\frac{f(10)-f(5)}{10-5} + \frac{f(5)-f(0)}{5-0}\right) = -4.5 \\
f'(10) &\approx \frac{1}{2}\left(\frac{\frac{f(15)-f(10)}{15-10} + f(10)-f(5)}{10-5}\right) = -2.4 \\
f'(15) &\approx \frac{1}{2}\left(\frac{f(20)-f(15)}{20-15}\frac{f(15)-f(10)}{15-10}\right) = -1.5 \\
f'(20) &= \frac{f(20)-f(15)}{20-15} = -1.2.
\end{aligned}
$$

11. We have

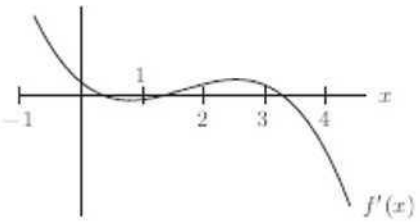
time interval	[-0.1,0]	[-0.01,0]	[-0.001,0]	[0,0.001]	[0,0.01]	[0,0.1]
Average velocity	9.486	9.526	9.531	9.531	9.536	9.577

Thus, $R'(0) \approx 9.53$.

13. This is a line with slope 1. Hence, $f'(x) = 1$ for all x so that the graph is a horizontal line at $y = 1$.



15.



25. Since $f'(x) > 0$ for $1 < x < 3$, $f(x)$ is increasing on this interval.
Since $f'(x) < 0$ for $x < 1$ or $x > 3$, $f(x)$ is decreasing on these intervals.
Since $f'(x) = 0$ for $x = 1$ and $x = 3$, the tangent to $f(x)$ will be horizontal at these x's.
One of many possible shapes of $y = f(x)$ is shown in Figure 2.10.

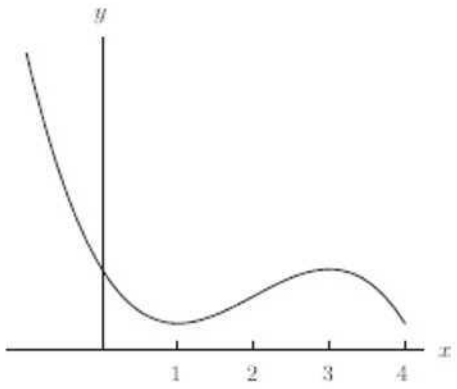


Figure 2.10

27. We have

$$f'(1) \approx \frac{f(1.001) - f(1)}{1.001 - 1} \approx 1$$
$$f'(2) \approx \frac{f(2.001) - f(2)}{2.001 - 2} \approx 0.5$$
$$f'(3) \approx \frac{f(3.001) - f(3)}{3.001 - 3} \approx 0.333$$
$$f'(4) \approx \frac{f(4.001) - f(4)}{4.001 - 4} \approx 0.25$$
$$f'(5) \approx \frac{f(5.001) - f(5)}{5.001 - 5} \approx 0.2.$$

(b) $f'(x) = \frac{1}{x}$.

29. (a) III (b) III (c) III and IV (d) II and IV.