

2.4

$$\lim_{h \rightarrow 0} \frac{19 \mid y = x^2 + 2}{\frac{[(a+h)^2 + 2] - [a^2 + 2]}{h}}$$

$$\lim_{h \rightarrow 0} \frac{[a^2 + 2ah + h^2 + 2] - [a^2 + 2]}{h}$$

$$\lim_{h \rightarrow 0} \frac{h(2a+h)}{h} = 2a$$

$$15 \mid f(0) = 2 \qquad f(x) = \begin{cases} 2 - 2x - x^2, & x < 0 \\ 2x + 2, & x \geq 0 \end{cases}$$

$$\lim_{h \rightarrow 0^-} \frac{[2 - 2(0+h) - (0+h)^2] - [2 - 2(0) - (0)^2]}{h}$$

$$\lim_{h \rightarrow 0^-} \frac{[2 - 2h - h^2] - [2]}{h}$$

$$\lim_{h \rightarrow 0^-} \frac{h(-2-h)}{h} = \boxed{-2}$$

$$\lim_{h \rightarrow 0^+} \frac{[2(0+h) + 2] - [2(0) + 2]}{h}$$

$$\lim_{h \rightarrow 0^+} \frac{[2h + 2] - [2]}{h}$$

$$\lim_{h \rightarrow 0^+} \frac{2h}{h} = \boxed{2}$$

$$23 \mid 100 - 4.9t^2$$

$$\lim_{h \rightarrow 0} \frac{[100 - 4.9(2+h)^2] - [100 - 4.9(2)^2]}{h}$$

$$\lim_{h \rightarrow 0} \frac{[100 - 4.9(4 + 4h + h^2)] - [100 - 4.9(4)]}{h}$$

# 2.4

23 (cont.)

$$\lim_{h \rightarrow 0} \frac{[100 - 19.6 - 19.6h - 4.9h^2] - [100 - 19.6]}{h}$$

$$\lim_{h \rightarrow 0} \frac{-19.6 - 4.9h}{1} = -19.6 \text{ m/s}$$

$$\boxed{19.6 \text{ m/s}}$$

31)  $y = \frac{1}{x-1}$

$$\lim_{h \rightarrow 0} \frac{[\frac{1}{(a+h)-1}] - [\frac{1}{a-1}]}{h}$$

$$\lim_{h \rightarrow 0} \frac{(a-h) - (a+h-h)}{[(a+h-1)(a-1)]}$$

$$\lim_{h \rightarrow 0} \frac{-h}{h}$$

$$\lim_{h \rightarrow 0} \frac{-1}{(a+h-1)(a-1)} = \frac{-1}{(a-1)^2}$$

$$\frac{-1}{(a-1)^2} = -1$$

$$1 = (a-1)^2$$

$$\pm 1 = a-1$$

$$1 \pm 1 = a$$

$$0, 2 = a$$

$$0, 2 = a$$

b)  $m = 1$

$$(0, -1) \quad (2, 1)$$

$$y = mx + b$$

$$-1 = 1(0) + b$$

$$-1 = b$$

$$\boxed{y = x - 1}$$

$$y = \frac{1}{0-1} = -1$$

$$y = \frac{1}{2-1} = 1$$

$$m = -1$$

$$(0, -1)$$

$$(2, 1)$$

$$y = mx + b$$

$$-1 = -1(0) + b$$

$$-1 = b$$

$$y = mx + b$$

$$1 = -1(2) + b$$

$$3 = b$$

$$a) \begin{cases} y = -1x - 1 \\ y = -1x + 3 \end{cases}$$