$f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$; $f(x) = mx+b$

$= \lim_{h\to 0} \frac{m(x+h)+b-(mx+b)}{h}$

$= \lim_{h\to 0} \frac{\cancel{mx} + mh + \cancel{b} - \cancel{mx} - \cancel{b}}{h}$

$= \lim_{h\to 0} \frac{m\cancel{h}}{\cancel{h}} = \lim_{h\to 0} (m) = \boxed{m}$.

23 (b) $f(x) = |x|$. Use the limit definition of the derivative to show that the derivative DNE at $x = 0$

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$f'(0) = \lim_{h\to 0} \frac{f(0+h) - f(0)}{h}$; $f(x) = |x|$

$\boxed{f'(0)} = \boxed{\lim_{h\to 0} \frac{|h|}{h}}$ DNE

left limit: $\lim_{\substack{h\to 0^- \\ h<0}} \frac{|h|}{h} = \lim_{h\to 0} \frac{(-h)}{h} = \lim_{h\to 0} (-1) = \boxed{-1}$

$\neq$

Right limit: $\lim_{\substack{h\to 0^+ \\ h>0}} \frac{|h|}{h} = \lim_{h\to 0} \frac{h}{h} = \lim_{h\to 0} (1) = \boxed{1}$

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24) (a) Find the values of x for which the tangent line to the graph of $f(x) = x\sqrt{x}$ $= x \cdot x^{\frac{1}{2}} = x^{\frac{3}{2}}$ is parallel to the line $y = \boxed{3}x + 1$.

$f'(x) = \boxed{\frac{3}{2} x^{\frac{1}{2}} = 3}$

$\frac{3}{2}\sqrt{x} = 3$

$\frac{\sqrt{x}}{2} = 1$; $\sqrt{x} = 2$; $\boxed{x = 4}$.

(24) (b) $f(x) = ax^2 + bx + c$.

Find a, b, c such that $f(2) = 5$; $f'(2) = 3$; $\boxed{f''(2) = 2}$

$f'(x) = 2ax + b$. $f''(x) = 2a$; $f''(2) = 2a = 2$; $\boxed{a = 1}$

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$f'(2) = 4a + b = 3$

$4 \cdot 1 + b = 3$; $b = -1$

$f(2) = 4a + 2b + c = 5$

$4 + (-2) + c = 5$

$2 + c = 5$; $c = 3$

$\boxed{f(x) = x^2 - x + 3}$

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