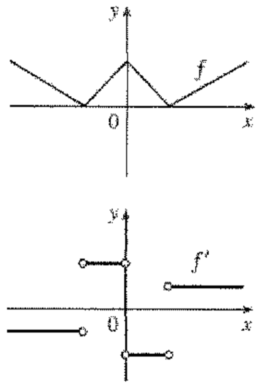
Hints First plot x-intercepts on the graph of f' for any horizontal tangents on the graph of f. Look for any corners on the graph of f—there will be a discontinuity on the graph of f'. On any interval where f has a tangent with positive (or negative) slope, the graph of f' will be positive (or negative). If the graph of the function is linear, the graph of f' will be a horizontal line.

1



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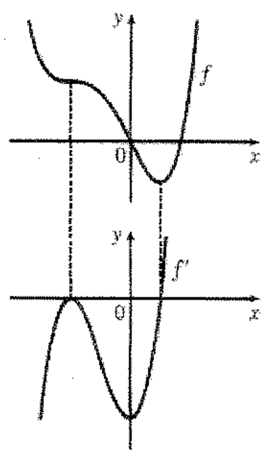

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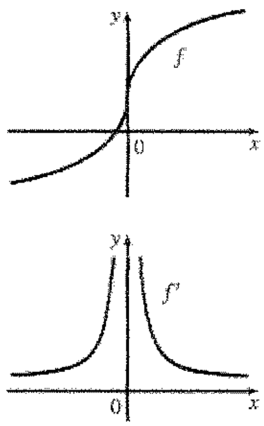


201 §2.2

Find derivative by defin of derivative. State $\mathcal{D}$ & $\mathcal{R}$ of f & f'!

4 $f(x) = \frac{1}{2}x - \frac{1}{3} \Longrightarrow$

$$\frac{f(x+h)-f(x)}{h} = \frac{1}{h}\left[f(x+h) - f(x)\right]$$

$$= \frac{1}{h}\left[\frac{1}{2}(x+h) - \frac{1}{3} - \left(\frac{1}{2}x - \frac{1}{3}\right)\right] = \frac{1}{h}\left[\frac{1}{2}x + \frac{1}{2}h - \frac{1}{3} - \frac{1}{2}x + \frac{1}{3}\right]$$

$$= \frac{1}{h}\left[\frac{1}{2}h\right] = \boxed{\frac{1}{2} = f'(x)}$$

$\mathcal{D}(f) = \mathcal{D}(f') = \mathbb{R}$

$\mathcal{R}(f) = \mathbb{R}$, $\mathcal{R}(f') = \{\frac{1}{2}\}$

$-6x^2 + 2x = -2(3x^2 - x) = -2x(3x-1)$

$x = 0$, $x = \frac{1}{3}$

$f'\left(\frac{1}{6}\right) = -6\left(\frac{1}{6}\right)^2 + 2\left(\frac{1}{6}\right) = \frac{1}{6}$

5 $f(x) = -2x^3 + x^2 \Longrightarrow \frac{f(x+h) - f(x)}{h}$

$$= \frac{-2(x+h)^3 + (x+h)^2 - (-2x^3 + x^2)}{h}$$

$$= \frac{-2(x^3 + 3x^2h + 3xh^2 + h^3) + (x^2 + 2xh + h^2) + 2x^3 - x^2}{h}$$

$$= \frac{-2x^3 - 6x^2h - 6xh^2 - 2h^3 + x^2 + 2xh + h^2 + 2x^3 - x^2}{h}$$

$$= \frac{-6x^2h - 6xh^2 - 2h^3 + 2xh + h^2}{h} = -6x^2 - 6xh - 2h^2 + 2x + h$$

$\mathcal{D}(f) = \mathcal{R}(f) = \mathbb{R}$

$h \to 0 \quad \boxed{-6x^2 + 2x \quad \mathcal{D}(f') = \mathbb{R},\ \mathcal{R}(f') = \left(-\infty, \frac{1}{6}\right]}$

201 §2.2

6 $g(t) = \frac{1}{\sqrt{t}} \Longrightarrow \dfrac{g(t+h) - g(t)}{h}$

$$= \frac{1}{h}\left[\frac{1}{\sqrt{t+h}} - \frac{1}{\sqrt{t}}\right]$$

$$= \frac{1}{h}\left[\frac{1}{\sqrt{t+h}} \cdot \frac{\sqrt{t}}{\sqrt{t}} - \frac{1}{\sqrt{t}} \cdot \frac{\sqrt{t+h}}{\sqrt{t+h}}\right] = \frac{1}{h}\left[\frac{\sqrt{t} - \sqrt{t+h}}{\sqrt{t}\sqrt{t+h}}\right]$$

still can't let $h \to 0$ ...

$$= \frac{1}{h}\left[\frac{\sqrt{t} - \sqrt{t+h}}{\sqrt{t}\sqrt{t+h}}\right]\left[\frac{\sqrt{t} + \sqrt{t+h}}{\sqrt{t} + \sqrt{t+h}}\right]$$

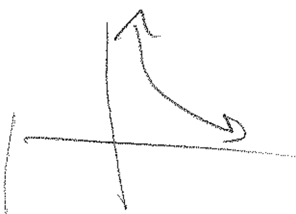
$$= \frac{1}{h}\left[\frac{t - (t+h)}{\sqrt{t(t+h)}\,(\sqrt{t} + \sqrt{t+h})}\right] = \frac{1}{h}\left[\frac{t - t - h}{\sqrt{t(t+h)}\,(\sqrt{t} + \sqrt{t+h})}\right]$$

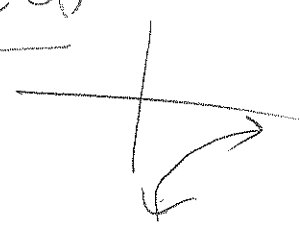
$$= \frac{-1}{\sqrt{t(t+h)}\,(\sqrt{t} + \sqrt{t+h})} \xrightarrow{h \to 0} \frac{-1}{\sqrt{t^2}\,(\sqrt{t} + \sqrt{t})}$$

$$= \frac{-1}{|t|(2\sqrt{t})} = \boxed{-\frac{1}{2} \cdot \frac{1}{t\sqrt{t}}} \text{ OR } -\frac{1}{2}t^{-3/2} \text{ OR...}$$

$|t| = t$, since $t < 0 \notin \mathcal{D}(g)$

$$\boxed{\begin{array}{l} \mathcal{D}(g) = (0, \infty),\ \mathcal{R}(g) = (0, \infty) \\ \mathcal{D}(g') = (0, \infty),\ \mathcal{R}(g') = (-\infty, 0) \end{array}}$$





201 §2.2

Didn't get to in class, but here it is.

$$g(x)=\sqrt{9-x} \longrightarrow \frac{g(x+h)-g(x)}{h}$$

$$= \frac{1}{h}\left[\sqrt{9-(x+h)} - \sqrt{9-x}\right]$$

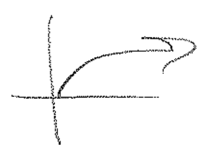
$$= \left(\frac{\sqrt{9-(x+h)}-\sqrt{9-x}}{h}\right)\left(\frac{\sqrt{9-(x+h)}+\sqrt{9-x}}{\sqrt{9-(x+h)}+\sqrt{9-x}}\right)$$

$$= \frac{9-(x+h)-(9-x)}{h\left(\sqrt{9-(x+h)}+\sqrt{9-x}\right)}$$

$$= \frac{9-x-h-9+x}{h\left(\sqrt{9-(x+h)}+\sqrt{9-x}\right)} = \frac{-1}{\sqrt{9-(x+h)}+\sqrt{9-x}} \quad \xrightarrow{h\to 0}$$

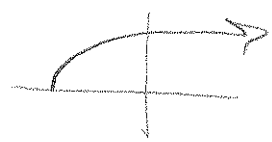
$$\xrightarrow{h\to 0} \boxed{\frac{-1}{2\sqrt{9-x}}}$$

$\sqrt{x}$



$\sqrt{9-x} = \sqrt{-x+9}$

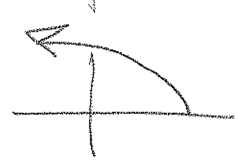
$\sqrt{x+9}$



$\mathcal{D}(g)=(-\infty,9],\ \mathcal{R}(g)=[0,\infty)$

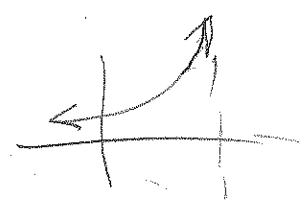
$\mathcal{D}(g')=(-\infty,9),\ \mathcal{R}(g')=(-\infty,0)$

$\sqrt{-x+9}$

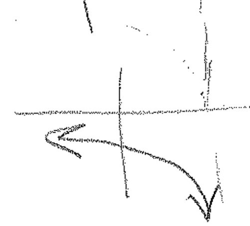


$-\frac{1}{2}\cdot\frac{1}{\sqrt{9-x}}$

$\frac{1}{\sqrt{9-x}}$



$-\frac{1}{2}\cdot\frac{1}{\sqrt{9-x}}$



$\boxed{7}$

$a = f$, $b = f'$, $c = f''$. We can see this because where a has a horizontal tangent, $b = 0$, and where b has a horizontal tangent, $c = 0$. We can immediately see that c can be neither f nor f', since at the points where c has a horizontal tangent, neither a nor b is equal to 0.

$\boxed{8}$

We can immediately see that a is the graph of the acceleration function, since at the points where a has a horizontal tangent, neither c nor b is equal to 0. Next, we note that $a = 0$ at the point where b has a horizontal tangent, so b must be the graph of the velocity function, and hence, $b' = a$. We conclude that c is the graph of the position function.