+8

1. If $h(x) = \arcsin(1-x)$, find $h'(x)$.

$f(x) = \arcsin(x)$ $\quad f'(x) = \frac{1}{\sqrt{1-x^2}}$

$g(x) = 1-x$ $\quad g'(x) = -1$

$f'(g(x))\, g'(x)$

$\frac{1}{\sqrt{1-g(x)^2}} \cdot -1$

$\frac{-1}{\sqrt{1-(1-x)^2}} = \frac{-1}{\sqrt{1-(1-2x+x^2)}} = \frac{-1}{\sqrt{2x-x^2}}$

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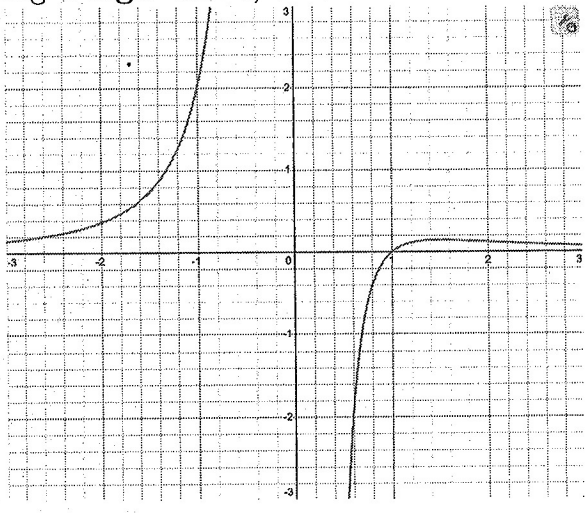
2. Consider $f(x) = \frac{x-1}{x^3}$, where $f'(x) = \frac{3-2x}{x^4}$ and $f''(x) = \frac{6(x-2)}{x^5}$. By creating a **sign chart,** find the intervals where $f(x)$ is concave up and concave down.



VA at $x=0$

$f''(x) = 0$

$6(x-2) = 0$

$x-2 = 0$

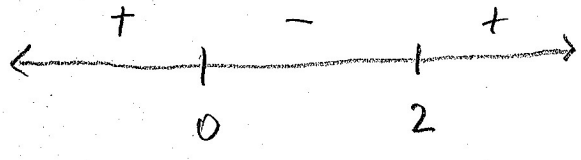
$x = 2$

Test points:

$f''(-1) = 18 > 0$

$f''(1) = -6 < 0$

$f''(3) = \frac{6}{3^5} > 0$



CU: $(-\infty, 0) \cup (2, \infty)$

CD: $(0, 2)$

+10

3. You are standing on the roof of a building which is 15 m tall. You throw a marble down from the roof at 5 m/s. How long will it take to hit the ground?

$$s(t) = -4.9t^2 + v_0 t + s_0 = -4.9t^2 - 5t + 15 = 0$$

$$t = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(-4.9)(15)}}{2(-4.9)}$$

$$= \frac{5 \pm \sqrt{25 + 294}}{-9.8}$$

$$= \frac{5 \pm 17.86}{-9.8}$$

$t = \cancel{-2.3}$ $\quad t = 1.3$ s

+10

4. Solve the initial value problem $f'(x) = x^2 + 4x - 3$, $f(2) = 0$.

$$f(x) = \int f'(x)\,dx$$

$$= \int (x^2 + 4x - 3)\,dx$$

$$= \frac{1}{3}x^3 + 2x^2 - 3x + C$$

$$f(2) = \frac{1}{3}\cdot 2^3 + 2\cdot 2^2 - 3\cdot 2 + C = 0$$

$$\frac{8}{3} + 8 - 6 + C = 0$$

$$\frac{14}{3} + C = 0$$

$$C = -\frac{14}{3} \rightarrow f(x) = \frac{1}{3}x^3 + 2x^2 - 3x - \frac{14}{3}$$