1. $\cancel{\boxed{f(x) = 4 + \frac{1}{3}x - \frac{1}{2}x^2}}$

$\cancel{f'(x) = \frac{1}{3} - x = 0/DNE}$

$\cancel{\boxed{x = \frac{1}{3} \rightarrow f' = 0}}$

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

$f'(x) = \frac{1}{x^2+3x+2} \cdot 2x+3 = 0/DNE$

$= \frac{2x+3}{(x+2)(x+1)} = 0/DNE$

$\boxed{x = -3/2 \rightarrow f' = 0}$

$\boxed{x = -2, -1 \rightarrow f' = DNE}$

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2. $\boxed{f(x) = x^2 \cdot e^{-3x}}$

$f'(x) = (e^{-3x})(2x) + (x^2)(e^{-3x} \cdot -3) = 0/DNE$

* FACTOR *

$\underbrace{e^{-3x}} \underbrace{(2x - 3x^2)} = 0/DNE$

$e^{-3x} = 0$

$x =$ none

$2x - 3x^2 = 0$

$x(2 - 3x) = 0$

$x = 0, +2/3$

$\boxed{x = 0, +2/3 \rightarrow f' = 0}$

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3. $\boxed{f(\theta) = 2\cos\theta + \sin^2\theta}$, $[0, 4\pi]$

rewrite $f(\theta) = 2\cos\theta + (\sin\theta)^2$

$f'(\theta) = -2\sin\theta + 2\sin\theta\cos\theta = 0/DNE$

* factor *

$\underbrace{-2\sin\theta} \underbrace{(1 - \cos\theta)} = 0/DNE$

$-2\sin\theta = 0$

$\sin\theta = 0$

$\theta = 0, \pi, 2\pi, 3\pi, 4\pi$

$1 - \cos\theta = 0$

$-\cos\theta = -1$

$\cos\theta = 1$

$\theta = 0, 2\pi, 4\pi$

$\boxed{x = 0, \pi, 2\pi, 3\pi, 4\pi \rightarrow f' = 0}$

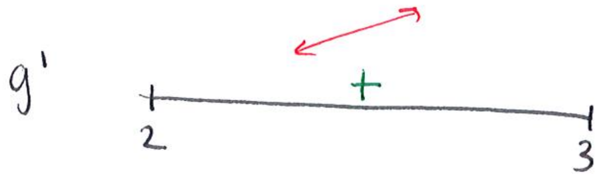
4. $\boxed{g(x) = 2x^3 - 3x^2 - 12x + 1,}$ $[2,3]$

$g'(x) = 6x^2 - 6x - 12 = 0/DNE$

$6(x^2 - x - 2) = 0$

$6(x-2)(x+1) = 0$

$x = 2, \cancel{-1}$ not in domain ← critical points



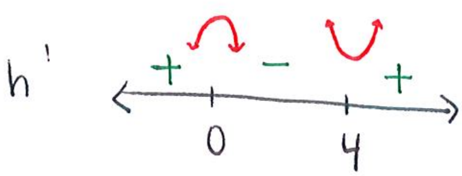
Extrema: $x=2$: absolute minimum
$x=3$: absolute maximum

. $\boxed{h(x) = x^3 - 6x^2 + 5}$

$h'(x) = 3x^2 - 12x = 0$

$3x(x-4) = 0$

$x = 0, 4$



Extrema: $x=0$: relative maximum
$x=4$: relative minimum

6. $\boxed{y = \sqrt[3]{t}\,(8-t)}$, $0 \le t \le 8$

...write

$$y = 8\cdot\sqrt[3]{t} - t(\sqrt[3]{t}) = 8t^{1/3} - t^{3/3}\cdot t^{1/3}$$

$$= 8t^{1/3} - t^{4/3}$$

$$y' = \frac{8}{3}t^{-2/3} - \frac{4}{3}t^{1/3} = 0 / \text{DNE}$$

factor

$$\underbrace{\frac{4}{3}t^{1/3}}\ \underbrace{(2t^{-1}-1)} = 0$$

$$\frac{4}{3}t^{1/3} = 0 \qquad\qquad 2t^{-1} - 1 = 0$$

$$t^{1/3} = 0 \qquad\qquad \frac{2}{t} - 1 = 0$$

$$(t^{1/3})^3 = (0)^3 \qquad\qquad \frac{2}{t} = 1$$

$t = 0 \leftarrow$ critical point $\qquad\qquad t = 2 \leftarrow$ critical point

y'   +   −

0   2   8

Extrema:	$x = 2$:	absolute maximum
	$x = 0$:	absolute minimum
	$x = 8$:	absolute minimum

check y-values for $x = 0, 8$

$$f(0) = \sqrt[3]{0}\,(8-0) = 0(8) = 0$$

$$f(8) = \sqrt[3]{8}\,(8-8) = 2(0) = 0$$

same.