Complete the sign chart and locate all extrema. x-value

1. Given $f(x)$ is continuous and differentiable.

Interval	$(-\infty,-2)$	$(-2,0)$	$(0,3)$	$(3,\infty)$
Test Value	$x=-4$	$x=-1$	$x=1$	$x=4$
$f'(x)$	$f'(-4)=4$	$f'(-1)=-3$	$f'(1)=-7$	$f'(4)=\frac{1}{2}$
Conclusion	↗	↘	↘	↗

MAX $f'(-2)=0$ $f'(0)=0$ MIN $f'(3)=0$

MAX @ $x=-2$

MIN @ $x=3$

Use a sign chart to find the intervals where the function is increasing or decreasing and relative extrema. x-value

2. $f(x)=x^3-12x+1$

CV

$f'(x)=3x^2-12$

$0=3(x^2-4)$

$0=3(x-2)(x+2)$

$0\neq 3$; $0=x-2$, $2=x$; $0=x+2$, $-2=x$

CV: $x=-2,2$

$f'=3(x-2)(x+2)$

$(-)(-)=+$, $f'>0$ | $(-)(+)=-$, $f'<0$ | $(+)(+)=+$, $f'>0$

-3, $f'(-2)=0$, 0, $f'(2)=0$, 3

↗ MAX ↘ MIN ↗

- The function is increasing from $(-\infty,-2)$ and $(2,\infty)$.
- The function is decreasing from $(-2,2)$.
- There is a maximum at $x=-2$ because $f'>0$ on the left and $f'<0$ on the right.
- There is a minimum at $x=2$ because $f'<0$ on the left and $f'>0$ on the right

3. $g(x)=x^2(x-3)$ pfft

$g(x)=x^3-3x^2$

CV

$g'(x)=3x^2-6x$

$0=3x(x-2)$

$0=3x$, $0=x$; $0=x-2$, $2=x$

CV: $x=0,2$

$g'=3x(x-2)$

$(-)(-)=+$, $f'>0$ | $(+)(-)=-$, $f'<0$ | $(+)(+)=+$, $f'>0$

-1, $g'(0)=0$, 1, $g'(2)=0$, 3

↗ MAX ↘ MIN ↗

- The function is increasing from $(-\infty,0)$ and $(2,\infty)$
- The function is decreasing from $(0,2)$.
- There is a maximum at $x=0$ because $f'>0$ on the left and $f'<0$ on the right.
- There is a minimum at $x=2$ because $f'<0$ on the left and $f'>0$ on the right

4. $f(x)=(x^2-1)^{\frac{2}{3}}$ Chain Rule

CV

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

$0=\frac{2}{3\sqrt[3]{x^2-1}}\cdot(2x)$

$0=\frac{4x}{3\sqrt[3]{(x-1)(x+1)}}$

ZON: $4x=0$, $x=0$

ZOD: $\sqrt[3]{(x-1)(x+1)}=0$, $(x-1)(x+1)=0$, $x-1=0$, $x=1$; $x+1=0$, $x=-1$

CV: $x=-1,0,1$

$f'=\frac{4x}{3\sqrt[3]{(x-1)(x+1)}}$

$\frac{(-)}{(-)(-)}=-$, $f'<0$ | $\frac{-}{(-)(+)}=+$, $f'>0$ | $\frac{+}{(-)(+)}=-$, $f'<0$ | $\frac{+}{(+)(+)}=+$, $f'>0$

-2, $f'(-1)=$ und, $-\frac{1}{2}$, $f'(0)=0$, $\frac{1}{2}$, $f'(1)=$ und, 2

↘ MIN ↗ MAX ↘ MIN ↗

The function is increasing from $(-1,0)$ and $(1,\infty)$

The function is decreasing from $(-\infty,-1)$ and $(0,1)$.

- There is a maximum at $x=0$ because $f'>0$ on the left and $f'<0$ on the right.
- There is a minimum at $x=-1$ and $x=1$ because $f'<0$ on the left and $f'>0$ on the right

5. $g(t)=12(1+\cos t)$ on the interval $[0,2\pi]$

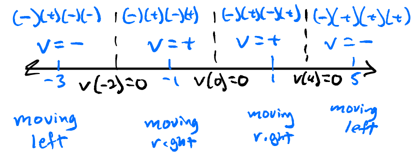
A particle moves along the *x*-axis with the position function given below. Find the velocity and use a sign chart to describe the motion of the particle.

6. $h(x) = -x^5 + \frac{5}{2}x^4 + \frac{40}{3}x^3 + 5$

$v = -5x^2(x-4)(x+2)$

CV

$$\boxed{\begin{array}{l} v(x) = -5x^4 + 10x^3 + 40x^2 \\ 0 = -5x^2(x^2 - 2x - 8) \\ 0 = -5x^2(x-4)(x+2) \\ 0 = -5x^2 \quad 0 = x-4 \quad 0 = x+2 \\ 0 = x^2 \quad\;\; 4 = x \quad\;\; -2 = x \\ 0 = x \\ CV: x = -2, 0, 4 \end{array}}$$



The particle is not moving at $x = -2, 0, 4$

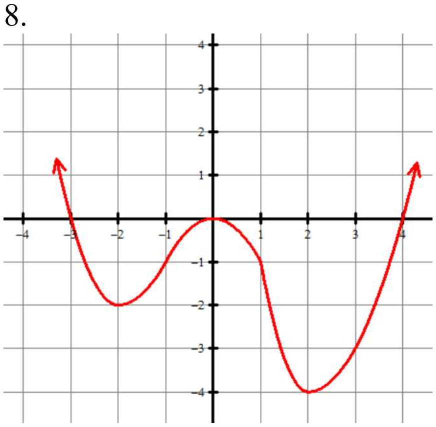
The particle is moving left from $(-\infty, -2)$ and $(4, \infty)$

The particle is moving right from $(-2, 0)$ and $(0, 4)$

7. $g(x) = e^{\cos x}$ on the interval $[0, 2\pi]$

Given the graph of $f'(x)$, find the critical points and locate all relative extrema.

8.



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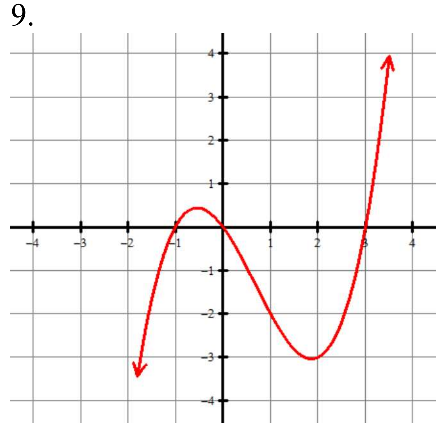

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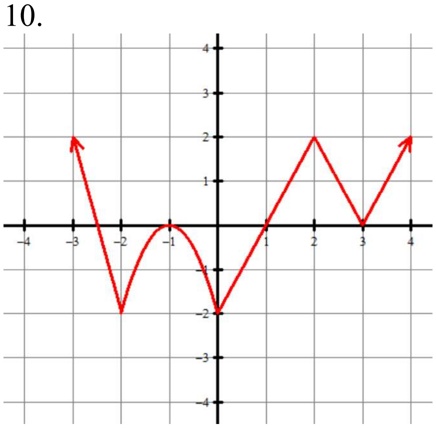

11.