

1. a) \downarrow over $(-\infty, 1)$; \uparrow over $(1, \infty)$
 b) \downarrow over $(-\infty, 1)$ or $(1, \infty)$
 c) \downarrow over $(-\infty, -1)$ or $(1, \infty)$
 \uparrow over $(-1, 1)$
 d) \downarrow over $(0, \frac{1}{3})$; \uparrow over $(\frac{1}{3}, \infty)$
 2. a) \downarrow over $(0, e^{-1})$; \uparrow over (e^{-1}, ∞)
 b) \downarrow over $(-\infty, -1)$; \uparrow over $(-1, \infty)$
 c) \downarrow over $(1, \infty)$; \uparrow over $(-\infty, 1)$
 d) \uparrow over \mathbb{R}

1. For each case, use the first derivative sign to find the intervals of increase or decrease.

- a) $f(x) = x^2 - 2x$ b) $f(x) = \frac{x}{x-1}$
 c) $f(x) = \frac{x}{x^2+1}$ d) $f(x) = \sqrt{x}(x-1)$

2. Find the intervals of increase or decrease.

- a) $f(x) = x \ln x$ b) $f(x) = xe^x$
 c) $f(x) = xe^{-x}$ d) $f(x) = x + \sin x$

3. a) $(-1, -1)$ b) $(0, 0)$; $(-1, 1)$
 c) $(0, 0)$ d) $(0, 0)$
 e) none f) $(\pm 1, \pm 1/2)$
 4. a) $(\frac{\pi}{2} + 2k\pi, 1)$; $(\frac{3\pi}{2} + 2k\pi, -1)$
 b) none c) none d) none
 e) $(\frac{1}{e}, \frac{-1}{e})$
 f) $(-1, \frac{-1}{e})$

3. For each case, find the critical points.

- a) $f(x) = x^2 + 2x$ b) $f(x) = 2x^3 + 3x^2$
 c) $f(x) = |x|$ d) $f(x) = \sqrt[3]{x}$
 e) $f(x) = \frac{1}{x^2}$ f) $f(x) = \frac{x}{x^2+1}$

4. For each case, find the critical points.

- a) $f(x) = \sin x$ b) $f(x) = \tan x$
 c) $f(x) = e^x$ d) $f(x) = \ln x$
 e) $f(x) = x \ln x$ f) $f(x) = xe^x$

5. a) Lm $(\pm 1, 0)$; LM $(0, 1)$
 b) Lm $(0, 0)$; LM $(1, 1)$
 c) none
 d) Lm $(\frac{1}{4}, -\frac{1}{4})$
 e) $(0.3968, -0.4724)$ Lm
 f) $(\pm 2, 0)$ Lm; $(0, 4)$ LM

5. For each case, find any local extrema using the first derivative test.

- a) $f(x) = x^4 - 2x^2 + 1$ b) $f(x) = x^2(3-2x)$
 c) $f(x) = \frac{1+x}{1-x}$ d) $f(x) = x - \sqrt{x}$
 e) $f(x) = x^2 - \sqrt{x}$ f) $f(x) = |x^2 - 4|$

6. a) GM $(-2, 2)$; Gm $(1, -6)$
 b) GM $(4, 4)$; Gm $(0, 0)$
 c) GM $(1, 5)$; GM $(4, 5)$
 Gm $(2, 4)$
 d) GM $(0, 1)$; GM $(2\pi, 1)$
 Gm $(\pi, -1)$
 e) wrong! $f(0)$ not defined
 f) GM $(1, 1/e)$; Gm $(-1, -e)$

6. For each case, find the absolute extrema (maximum or minimum) points.

- a) $f(x) = 2x^3 + 3x^2 - 12x + 1$, for $x \in [-3, 2]$
 b) $f(x) = \frac{5x}{x+1}$, for $x \in [0, 4]$
 c) $f(x) = x + \frac{4}{x}$, for $x \in [1, 4]$
 d) $f(x) = \cos x$, for $x \in [-\pi/2, 2\pi]$
 e) $f(x) = x \log x$, for $x \in [0, 10]$ $x \in [1, 10]$
 f) $f(x) = xe^{-x}$, for $x \in [-1, 2]$
 g) $f(x) = x + \sin x$, for $x \in [0, 2\pi]$