3.1 pp. 165 - 167 (1-29 odds, 33)

1. $f'(0) = 0$

3. $f'(3) = 0$

5. $f'(-2)$ DNE

7. $x = 2$, absolute maximum

9. $x = 1, 3$ absolute max.
$x = 2$ absolute min.

11. $f(x) = x^2(x-3)$
$f(x) = x^3 - 3x^2$
$f'(x) = 3x^2 - 6x$
$3x^2 - 6x = 0$
$3x(x-2) = 0$
$\boxed{x = 0, 2}$

13. $g(t) = t\sqrt{4-t}$, $t \leq 3$
$g(t) = t(4-t)^{1/2}$
$g'(t) = t \cdot \frac{1}{2}(4-t)^{-1/2} + (4-t)^{1/2}$
$g'(t) = \frac{t}{2\sqrt{4-t}} + \sqrt{4-t}$
$g'(t) = \frac{t + 2(4-t)}{2\sqrt{4-t}}$
$g'(t) = \frac{8+3t}{2\sqrt{4-t}}$
$g'(t) = 0$ when $8 + 3t = 0$
$\boxed{t = -8/3}$
$g'(t)$ DNE when $2\sqrt{4-t} = 0$
$t = 4$ not in domain
so only $t = -8/3$

15. $h(x) = \sin^2 x + \cos x$, $0 < x < 2\pi$
$h'(x) = 2\sin x \cos x - \sin x$
$h'(x) = 0$ when $\sin x(2\cos x - 1) = 0$
$\sin x = 0$ $\cos x = 1/2$
$\boxed{x = \pi \qquad x = \pi/3, 5\pi/3}$

17. $f(x) = 2(3-x)$ $[-1, 2]$
$f'(x) = -x$
$f'(x) = 0$ when $x = 0$
$f(-1) = 8$
$f(0) = 6$
$f(2) = 2$
$\boxed{\text{absolute max } (-1, 8)}$
$\boxed{\text{absolute min } (2, 2)}$

19. $f(x) = -x^2 + 3x$ $[0, 3]$
$f'(x) = -2x + 3$
$f'(x) = 0$ when $x = 3/2$
$f(0) = 0$
$f(3/2) = 2.25$ or $9/4$
$f(3) = 0$
$\boxed{\text{absolute max } (0,0) \text{ and } (3,0)}$
$\boxed{\text{absolute min } (3/2, 9/4)}$

21. $f(x) = x^3 - 3/2\,x^2$ $[-1, 2]$
$f'(x) = 3x^2 - 3x$
$f'(x) = 3x(x-1)$
$f'(x) = 0$ when $x = 0, 1$
$f(-1) = -5/2$
$f(0) = 0$
$f(1) = -1/2$
$f(2) = 2$
$\boxed{\text{absolute max } (2, 2)}$
$\boxed{\text{absolute min } (-1, -5/2)}$

23. $y = 3x^{2/3} - 2x \quad [-1,1]$

$y' = 2x^{-1/3} - 2$

$y' = \frac{2}{x^{1/3}} - 2$

$y' = \frac{2 - 2x^{1/3}}{x^{1/3}}$

$y' = 0$ when $x^{1/3} = 1$, $x = 1$

y' DNE when $x = 0$

$y(-1) = 5$

$y(0) = 0$

$y(1) = 1$

absolute max $(-1,5)$

absolute min $(0,0)$

25. $g(t) = \frac{t^2}{t^2+3} \quad [-1,1]$

$g'(t) = \frac{(t^2+3)(2t) - t^2(2t)}{(t^2+3)^2}$

$g'(t) = \frac{2t^3 + 6t - 2t^3}{(t^2+3)^2}$

$g'(t) = \frac{6t}{(t^2+3)^2}$

$g'(t) = 0$ when $t = 0$

$g(-1) = 1/4$

$g(0) = 0$

$g(1) = 1/4$

absolute max $(-1,1/4)$ $(1,1/4)$

absolute min $(0,0)$

27. $h(s) = \frac{1}{s-2} \quad [0,1]$

$h(s) = (s-2)^{-1}$

$h'(s) = -1(s-2)^{-2}$

$h'(s) = \frac{-1}{(s-2)^2}$

$h'(s)$ DNE when $s = 2$

but 2 not in interval

$h(0) = -1/2$

$h(1) = -1$

absolute max $(0, -1/2)$

absolute min $(1,-1)$

29. $f(x) = \cos(\pi x) \quad [0, 1/6]$

$f'(x) = -\sin(\pi x) \cdot \pi$

$f'(x) = -\pi \sin(\pi x)$

$f'(x) = 0$ when $\sin(\pi x) = 0$

since $\sin(u) = 0$ when $u = 0, \pi, 2\pi, \ldots$

$\pi x = 0 \quad \pi x = \pi \quad \pi x = 2\pi$

$x = 0 \quad x = 1 \quad x = 2$

↳ not in domain

$f(0) = 1$

$f(1/6) = \sqrt{3}/2$

absolute max $(1/6, \sqrt{3}/2)$

absolute min $(0,1)$

33. $f(x) = 2x - 3$

a. $[0,2]$
abs min $(0,-3)$
abs max $(2,1)$

b. $[0,2)$
abs min $(0,-3)$
no abs max

c. $(0,2]$
no abs min
abs max $(2,1)$

d. $(0,0)$
no abs min
no abs max