Homework 4-1

① local max? 3,8
local min? 2,5
global max? None
global min? 2

② $f(x) = e^{5x}(7x+6)$

$f' = 5e^{5x}(7x+6) + 7e^{5x}$

$35e^{5x}x + 30e^{5x} + 7e^{5x}$

$e^{5x}(35x+37)$

$f'=0$ when $x = \frac{-37}{35}$

③ $f(t) = t^4 - 12t^3 + 40t^2$

$f' = 4t^3 - 36t^2 + 80t$

$t(4t^2 - 36t + 80) = 0$

$4t(t-4)(t-5) = 0$

when crit: 4, 5, 0

④ $f(r) = \frac{3r}{9r^2+10}$

$f'(r) = 3(9r^2+10) - 3r(18r)$

$27r^2 + 30 - 54r^2 = 0$

$\frac{30}{27} = r$ = critical points

⑤ $f(x) = x^{\frac{5}{7}}(x-5)^2$

$f' = \frac{5}{7}x^{-\frac{2}{7}}(x-5)^2 + x^{\frac{5}{7}}2(x-5) = 0$

$\frac{5}{14}x^{-\frac{2}{7}}(x-5)^2 = -x^{\frac{5}{7}}2(x-5)$

$f' = \frac{5}{14}x^{\frac{5}{7}} - \frac{25}{14}x^{-\frac{2}{7}} + x^{\frac{5}{7}} = 0$

$19x^2 - 120x + 125 = 0$;

$(19x-25)(x-5) = 0$; $\frac{25}{19}$ & 5 & 0

⑥ $f(x) = 2x^3 + 18x^2 - 42x + 8$

$f' = 6x^2 + 36x - 42 = x^2 + 6x - 7 = 0$

$f' = (x+7)(x-1) = 0$; 1 & -7

Critical points: $-7, 1, 2$

⑦ $f(x) = x^3 + 12x^2 - 27x + 12$

$f' = 3x^2 + 24x - 27 = x^2 + 8x - 9 = 0$

$f' = (x+9)(x-1) = 0$; 1 & -9

Critical Points: $-10, -9, 0$

$(-10, 482)$; $(-9, 498)$; $(0, 12)$

⑧ $f(x) = x - \ln x$; $x \in [\frac{1}{9}, 9]$

$f' = 1 - \frac{1}{x} = 0$; $x = 1$

$f(x) = \frac{1}{9} - \ln(\frac{1}{9}) = 2.3$; $f(1) = 1$

$f(9) = 9 - \ln(9) = 6.802$

Homework 4-1

(9) $f(x) = x^7 e^{9x}$; $x \in [-1, 4]$

$7x^6 e^{9x} + x^7 9e^{9x} = 0$

$x^6 e^{9x}(7 + 9x) = 0 \therefore x = \frac{-7}{9}$

Critical Points: $\frac{-7}{9}, -1, 4$

$f(4) < f(-1) < f(\frac{-7}{9})$

abs min & max

(10) $f(t) = t\sqrt{16 - t^2}$; $t \in [-4, 4]$

$f' = \frac{1}{2}(16t^2 - t^4)^{-1/2}(32t - 4t^3) = 0$

$f' = 32t - 4t^3 = 4t(8 - t^2) = 0$

$f' = 0 ; \pm\sqrt{8}$: Critical Point

$f(\sqrt{8}) < f(4) = f(0) = f(-4) < f(\sqrt{8})$