(a) Let

$$f(x) = x^3(x-1)^2$$

Find all relative extrema of f.

(b) Find the absolute maximum and minimum of $f(x) = x^3 - 6x + 1$ on the interval $[-2, 0]$.

Howard University: Final 09

A cylindrical can is to have a volume of 1200 cm^3. The material for the side of the can costs 2 cents per cm^2 and the material for the top and bottom of the can costs 3 cents per cm^2. Find the radius of the base of the can which minimizes the cost.

Howard University: Final 09

(a) Let

$$f(x) = x^3(x-1)^2$$

Find all relative extrema of f.

(b) Find the ~~absolute maximum and minimum~~ of $f(x) = x^3 - 6x + 1$ on the interval $[-2, 0]$.

Howard University: Final 09

(a) $f'(x) = 3x^2(x-1)^2 + x^3[2(x-1)]$

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

$f'(x) = x^2(x-1)[3(x-1) + 2x]$

$f'(x) = x^2(x-1)(5x-3)$

Critical Values: $x = 0, 1, \frac{3}{5}$

	x^2	$x-1$	$5x-3$	f'	f
$(-\infty, 0)$	+	−	−	+	Inc
$(0, \frac{3}{5})$	+	−	−	+	Inc
$(\frac{3}{5}, 1)$	+	−	+	−	Dec
$(1, \infty)$	+	+	+	+	Inc

LOCAL MAX. $\left(\frac{3}{5}, 0.346\right)$

LOCAL MIN. $(1, 0)$

(b) $f(x) = x^3 - 6x + 1 \quad [-2, 0]$

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

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

$0 = 3(x - \sqrt{2})(x + \sqrt{2})$

$x = \pm\sqrt{2}$

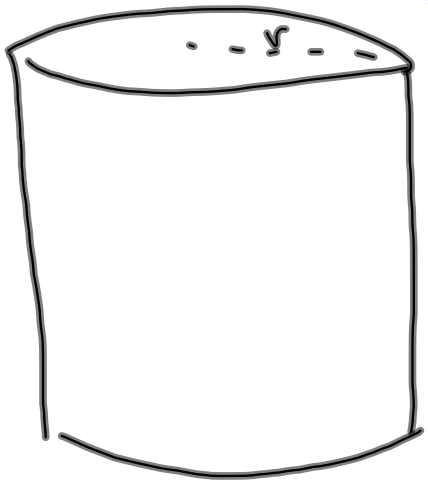
x	y
-2	5
$-\sqrt{2}$	6.7
0	1

Abs. Max = 6.7

Abs. Min. = 1

A cylindrical can is to have a volume of 1200 cm^3. The material for the side of the can costs 2 cents per cm^2 and the material for the top and bottom of the can costs 3 cents per cm^2. Find the radius of the base of the can which minimizes the cost.

Howard University: Final 09



$V = \pi r^2 h$

$SA = 2\pi r^2 + 2\pi rh$

$C = 3(2\pi r^2) + 2(2\pi rh)$

$C = 6\pi r^2 + 4\pi rh$

$C = 6\pi r^2 + 4\pi r\left(\frac{1200}{\pi r^2}\right)$

$1200 = \pi r^2 h$

$C = 6\pi r^2 + 4800 r^{-1}$

$h = \frac{1200}{\pi r^2}$

$C' = 12\pi r - 4800 r^{-2}$

$0 = 12\pi r - \frac{4800}{r^2}$

$0 = 12\pi r^3 - 4800$

$\sqrt[3]{\frac{4800}{12\pi}} = r$

$r = 5.03\,cm$

$h = \frac{1200}{\pi(5.03)^2}$

$h = 15.1\,cm$

Finish practice problems from textbook:

Practice Problems:

Page 188 - 191
#1, 2, 3, 5, 6, 7, 8, 10, 11
12, 16, 17, 20