$x_1 + x_2$

$p_1 = 1$, $p_2 = 2$, $m = 60$

$$(60, 0), (0, 30)$$

$$u(60, 0) = 60 + 0 = 60$$

$$u(0, 30) = 0 + 30 = 30$$

2.

$$2x_1 + 5x_2$$

$$p_1 = 5, p_2 = 2, m = 60$$

$$\left(\frac{60}{5}, 0\right), \left(0, \frac{60}{2}\right)$$

$$(12, 0), (0, 30)$$

$$u(12, 0) = 2(12) + 5(0) = 24$$

$$u(0, 30) = 2(0) + 5(30) = 150$$

What if I spend half of my money on both goods?

$$\left(\frac{\frac{1}{2}m}{p_1}, \frac{\frac{1}{2}m}{p_2}\right) = \left(\frac{30}{5}, \frac{30}{2}\right) = (6, 15)$$

$$u(6, 15) = 2(6) + 5(15) = 87$$

$min\{x_1, x_2\}$

$p_1 = 1, p_2 = 2, m = 60$

No Waste

$$x_1 = x_2$$

$$x_1 + 2x_2 = 60$$

$$x_1 + 2\left(x_1\right) = 60$$

$$3x_1 = 60$$

$$x_1 = \frac{60}{3} = 20$$

$$x_2 = 20$$

$$(20, 20)$$

1 Problem 8

$min\left\{\frac{1}{2}x_1, x_2\right\}$
$p_1 = 1, p_2 = 2, m = 60$

$$\frac{1}{2}x_1 = x_2$$

$$1x_1 + 2x_2 = 60$$

$$1x_1 + 2\left(\frac{1}{2}x_1\right) = 60$$

$$x_1 + x_1 = 60$$

$$2x_1 = 60$$

$$x_1 = 30$$

$$\frac{1}{2}(30) = x_2$$

$$x_2 = 15$$

$$(30, 15)$$

2 Problem 4

$max\{x_1, x_2\}$, $p_1 = 1, p_2 = 2, m = 60$.

One of the endpoints will be optimal.

$$\left(\frac{60}{1}, 0\right), \left(0, \frac{60}{2}\right)$$

$$(60, 0), (0, 30)$$

This bundle is optimal:

$$(60, 0)$$

3 Exercise 5

$$x_1 x_2$$

$$\left(\frac{\frac{1}{2}m}{p_1}, \frac{\frac{1}{2}m}{p_2}\right)$$

4 Exercise 14

$p_1 = 1, p_2 = 1, m = 60$

$$x_1^{\frac{1}{3}} x_2^{\frac{2}{3}}$$

$$MRS = -\frac{p_1}{p_2}$$

$$MRS = -\frac{1}{1}$$

$$\frac{\partial \left(x_1^{\frac{1}{3}} x_2^{\frac{2}{3}} \right)}{\partial x_1} = x_2^{\frac{2}{3}} \frac{1}{3} x_1^{\frac{1}{3}-1} = \frac{1}{3} x_2^{\frac{2}{3}} x_1^{-\frac{2}{3}}$$

$$\frac{\partial \left(x_1^{\frac{1}{3}} x_2^{\frac{2}{3}} \right)}{\partial x_2} = x_1^{\frac{1}{3}} \frac{2}{3} x_2^{\frac{2}{3}-1} = x_1^{\frac{1}{3}} \frac{2}{3} x_2^{-\frac{1}{3}}$$

$$MRS = -\frac{\frac{1}{3} x_2^{\frac{2}{3}} x_1^{-\frac{2}{3}}}{x_1^{\frac{1}{3}} \frac{2}{3} x_2^{-\frac{1}{3}}} = -\frac{\frac{1}{3} x_2^{\frac{2}{3}} x_2^{\frac{1}{3}}}{\frac{2}{3} x_1^{\frac{1}{3}} x_1^{\frac{2}{3}}} = -\frac{\frac{1}{3} x_2}{\frac{2}{3} x_1} = -\frac{\frac{3}{2} \frac{1}{3} x_2}{x_1} = -\frac{1}{2} \frac{x_2}{x_1}$$

Tangency:

$$-\frac{1}{2} \frac{x_2}{x_1} = -1$$

$$\frac{1}{2} \frac{x_2}{x_1} = 1$$

$$\frac{1}{2} \frac{x_2}{1} = x_1$$

$$x_2 = 2x_1$$

Budget Constraint:

$$x_1 + x_2 = 60$$

$$x_1 + (2x_1) = 60$$

$$3x_1 = 60$$

$$x_1 = 20$$

$$x_2 = 2x_1$$

$$x_2 = 40$$

$$\frac{\frac{1}{3}m}{p_1}, \frac{\frac{2}{3}m}{p_2}$$

$$(20, 40)$$

5 Exercise 8 Chapter 7

$ln\left(x_1\right) + x_2$

Tangency Condition

$$MRS = -\frac{p_1}{p_2}$$

$$\frac{\partial\left(ln\left(x_1\right) + x_2\right)}{\partial x_1} = \frac{1}{x_1}$$

$$\frac{\partial\left(ln\left(x_1\right) + x_2\right)}{\partial x_2} = 1$$

$$MRS = -\frac{\frac{1}{x_1}}{1} = -\frac{1}{x_1}$$

$$-\frac{1}{x_1} = -\frac{p_1}{p_2}$$

$$x_1 = \frac{p_2}{p_1}$$

Budget Condition

$$p_1 x_1 + p_2 x_2 = m$$

$$p_1 \left(\frac{p_2}{p_1}\right) + p_2 x_2 = m$$

$$p_2 + p_2 x_2 = m$$

$$p_2 x_2 = m - p_2$$

$$x_2 = \frac{m - p_2}{p_2}$$

$$\left(\frac{p_2}{p_1}, \frac{m - p_2}{p_2}\right)$$

6 Exercise 1 Chapter 7

$$x_1 = \frac{m - p_2}{p_1}$$

Ordinary, Normal, Complements