1. For each of the following utility functions, find the MRS.

A) $x_1 x_2$. $MRS = -\frac{\frac{\partial(x_1 x_2)}{\partial x_1}}{\frac{\partial(x_1 x_2)}{\partial x_2}} = -\frac{x_2}{x_1}$

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

C) $(2x_1)^2 (2x_2)^2$. $MRS = -\frac{\frac{\partial\left((2x_1)^2 (2x_2)^2\right)}{\partial x_1}}{\frac{\partial((2x_1)^2 (2x_2)^2)}{\partial x_2}} = -\frac{x_2}{x_1}$

D) $\sqrt{x_1^2 - 3x_2}$. $MRS = -\frac{\frac{\partial\left(\sqrt{x_1^2-3x_2}\right)}{\partial x_1}}{\frac{\partial\left(\sqrt{x_1^2-3x_2}\right)}{\partial x_2}} = \frac{2x_1}{3}$. *Note that the MRS is positive. This is because the preferences are not monotonic. Utility is decreasing in* x_2.

E) $ln\left[\left(2x_1^3\right)\left(2x_2^3\right)\right]$. $MRS = -\frac{\frac{\partial\left(ln\left[\left(2x_1^3\right)\left(2x_2^3\right)\right]\right)}{\partial x_1}}{\frac{\partial\left(ln\left[\left(2x_1^3\right)\left(2x_2^3\right)\right]\right)}{\partial x_2}} = -\frac{x_2}{x_1}$

F) $x_1 + x_1 x_2$. $MRS = -\frac{\frac{\partial(x_1+x_1 x_2)}{\partial x_1}}{\frac{\partial(x_1+x_1 x_2)}{\partial x_2}} = -\frac{x_2+1}{x_1}$

Note that A,C,E have the same MRS. They represent the same preferences.

2. Sketch a few indifference curves of the following utility functions.

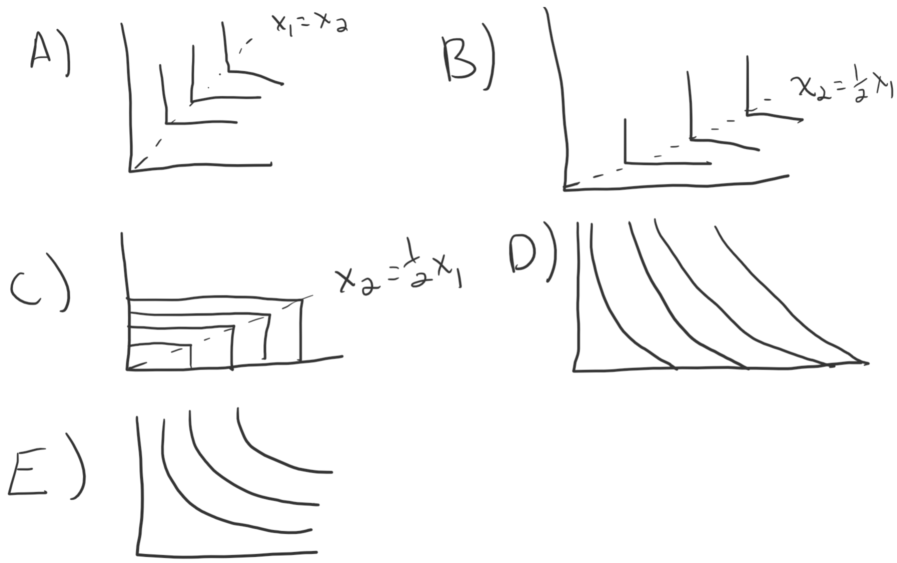
A) $min\{x_1, x_2\}$

B) $min\{x_1, 2x_2\}$

C) $max\{x_1, 2x_2\}$

D) $x_1 + x_1 x_2$

E) $x_1^2 x_2^2$



3. At prices $p_1 = 1$ and $p_2 = 2$ with income $m = 10$, what bundle of goods is optimal for the following utility functions?

A) $x_1 + 2x_2$. **Any bundle such that $x_1 + 2x_2 = 10$.**

B) $x_1 x_2$. $(5, 2.5)$

C) $x_1 + ln\,(x_2)$. $\left(9, \frac{1}{2}\right)$

D) $min\,\{x_1, x_2\}$. $\left(\frac{10}{3}, \frac{10}{3}\right)$

E) $min\,\{2x_1, x_2\}$. $(2, 4)$