Assignment 3

Let x_j = type of backpack where: j=1 – Collegiate; j=2 – Mini and Z = profit.

Objective function: $Z = 32x_1 + 24x_2$

Nonnegativity constraints place us in quadrant 1

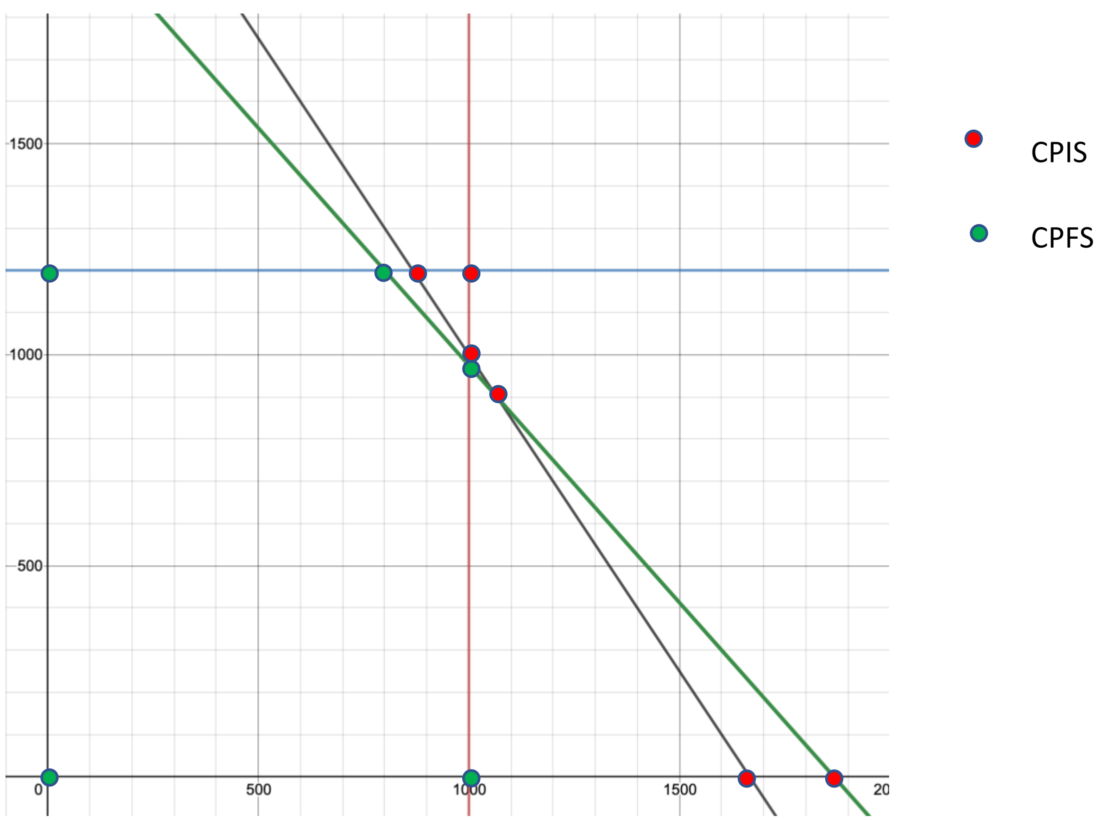
$x_1, x_2 \geq 0$

Arrange functional constraints in y = mx + b form for graphing.

$x_1 \leq 1000 \rightarrow x_1 = 1{,}000$ (Red Line)
$x_2 \leq 1{,}200 \rightarrow x_2 = 1{,}200$ (Blue Line)

$3x_1 + 2x_2 \leq 5{,}000 \rightarrow x_2 = -(3/2)x_1 + 2{,}500$ (Black Line)

$45x_1 + 40x_2 \leq 84{,}000 \rightarrow x_2 = -(9/8) + 2{,}100$ (Green Line)



CPF Solution	Adjacent CPF Solutions
(0,0)	(1000,0) & (0,1200)
(1000, 0)	(0,0) & (1000,975)
(1000,975)	(1000,0) & (800, 1200)
(800, 1200)	(1000, 975) & (0,1200)
(0,1200)	(0,1200) & (0,0)

1. *Initialization:* Starting at CPF (0,0)

2. *Optimality Test:* (0,0) is not optimal as it yields a Z value of zero.

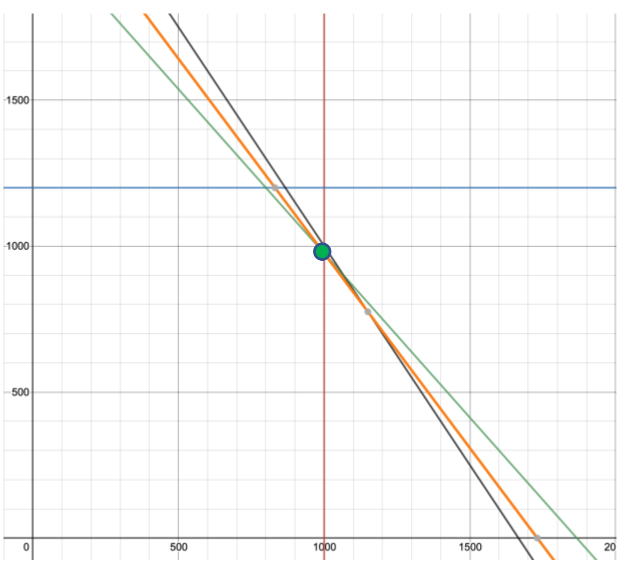
3. *Iteration 1:* Because x_1 increases Z at a faster rate that x_2 (32 >24), move along the edge to the adjacent CPF that increases x_1 (1000,0)

4. *Optimality Test:* (1000,0) yields a Z value of 32,000. This is not optimal because the adjacent CPF value (1000, 975) increases x_2 while x_1 stays at 1000.

5. *Iteration 2:* Move to CPF (1000, 975)

6. *Optimality Test:* The Value (1000, 975) yields a value of 55,400 which is the optimal solution. This is because the only other adjacent CPF is (800,1200) which would yield a lower Z value (54,400).

The optimal mix of products that maximizes profits is 1000 Collegiate backpacks (x_1) and 975 mini backpacks (x_2) that maximizes profit at $55,400. (Plotted with orange line: $(55{,}400/24)-(32/24)x_1 = x_2$



Optimal Solution plotted with orange line:

$x_2 = (55{,}400/24) - (32/24)x_1$