

Substitution and Income Effect when P_y changes

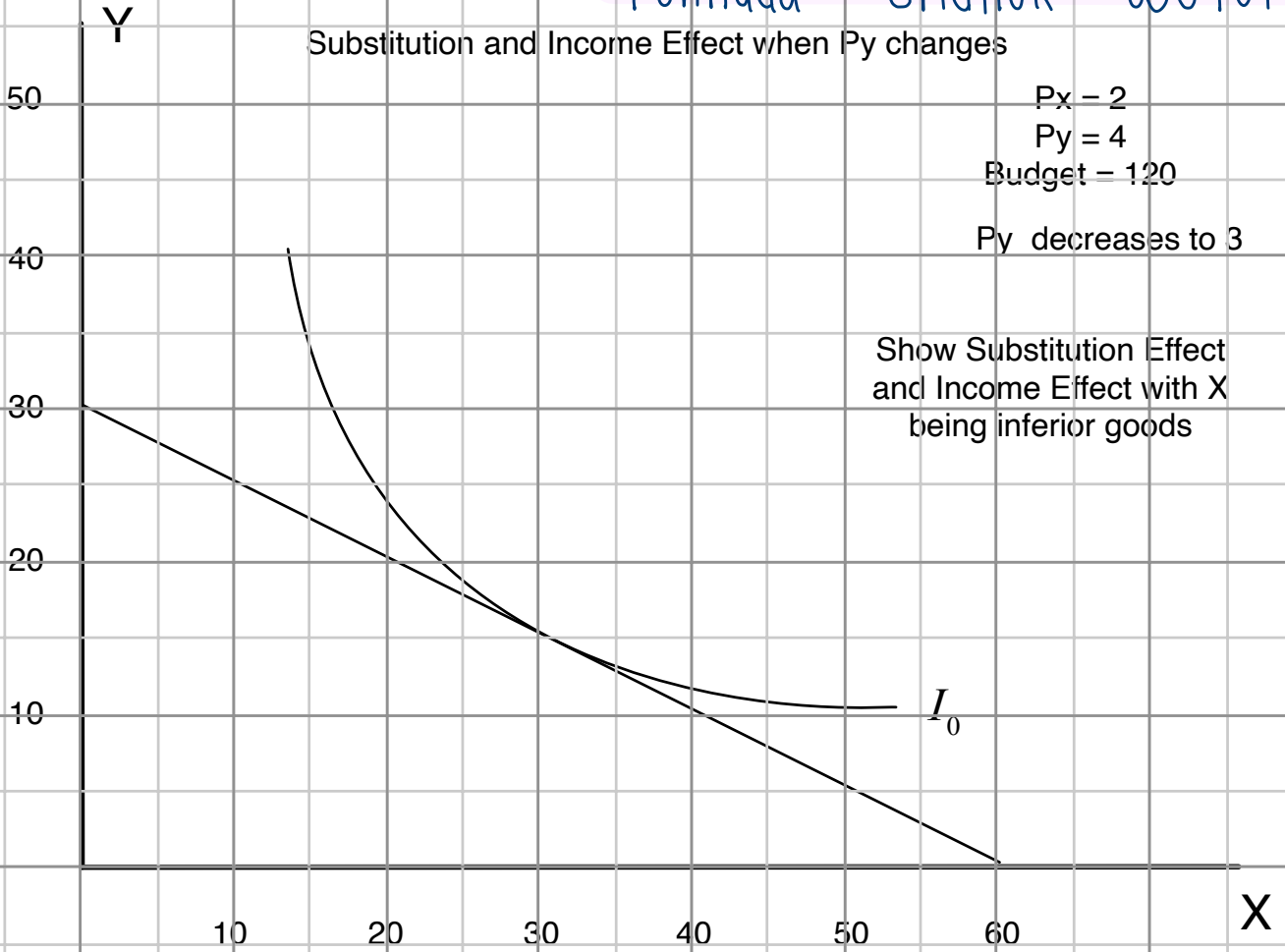
$P_x = 2$

$P_y = 4$

Budget = 120

P_y decreases to 3

Show Substitution Effect and Income Effect with X being inferior goods



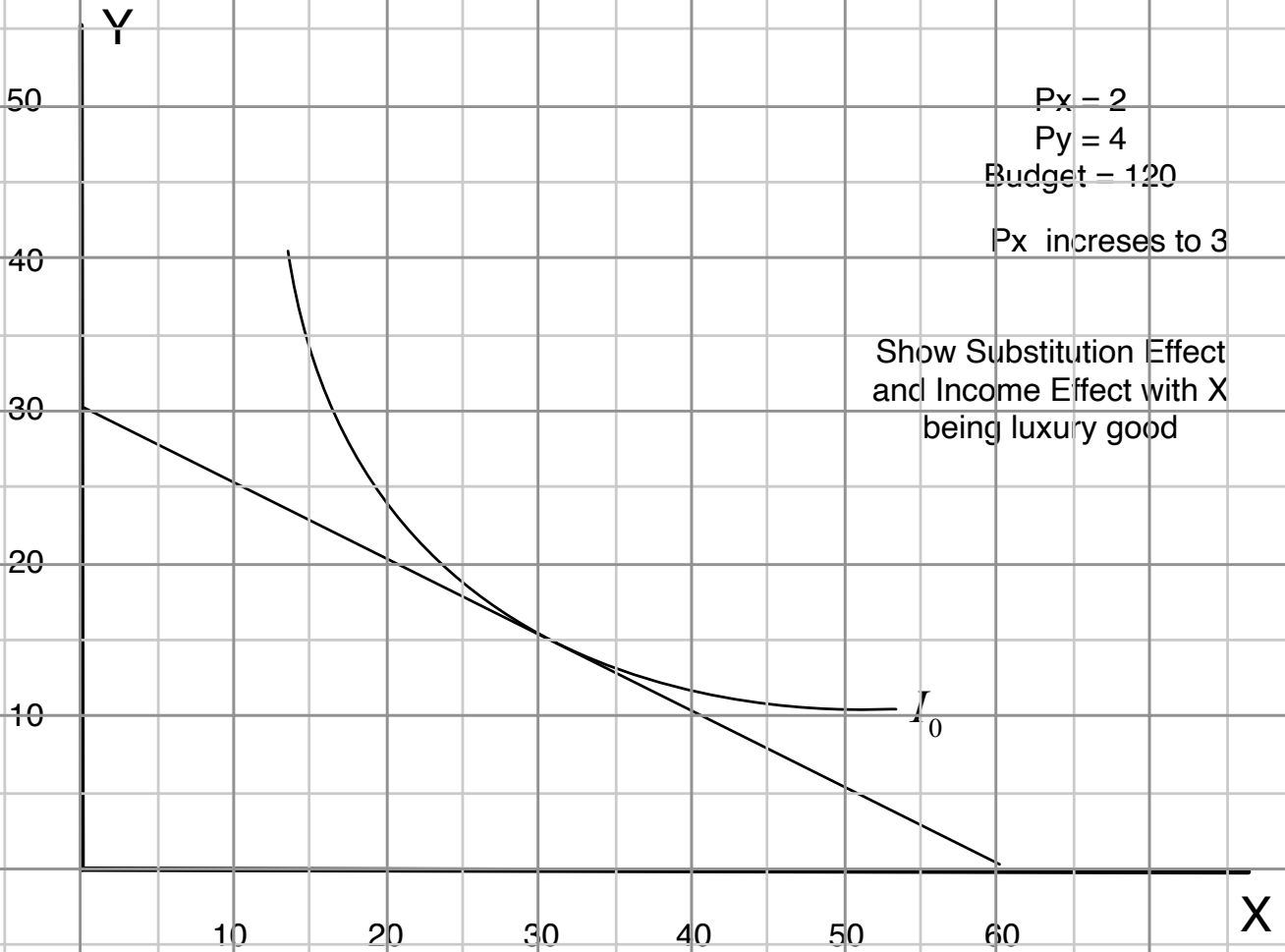
$P_x = 2$

$P_y = 4$

Budget = 120

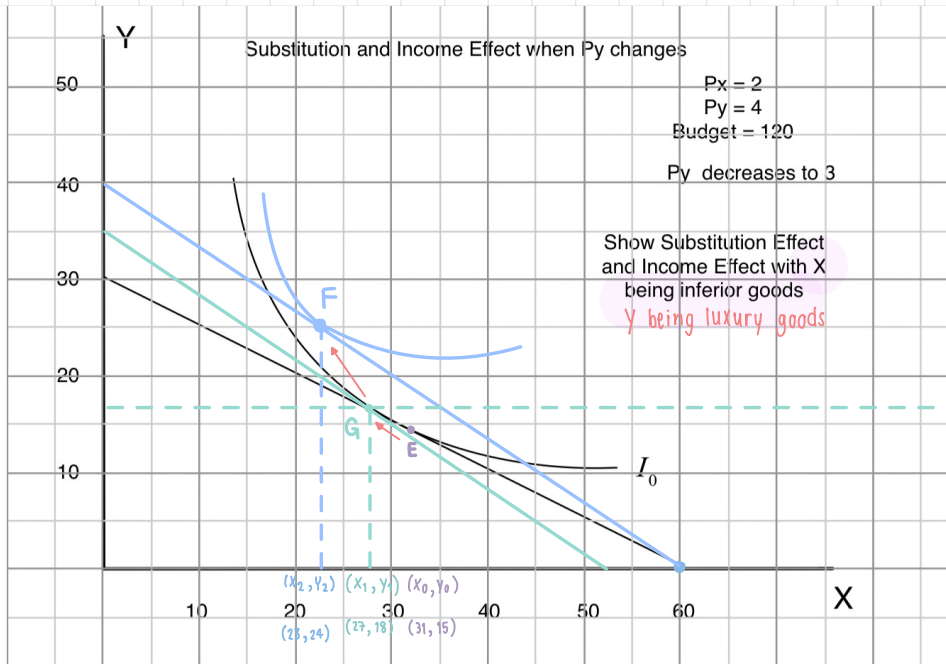
P_x increases to 3

Show Substitution Effect and Income Effect with X being luxury good



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1.



• Old

$$\begin{aligned} XP_x + YP_y &= B \\ 2x + 4y &= 120 \\ 4y &= -2x + 120 \\ y &= -\frac{1}{2}x + 30 \end{aligned}$$

• New

$$\begin{aligned} XP_x + YP_y &= B \\ 2x + 3y &= 120 & -y\text{-int } (x=0) &= 40 \\ 3y &= -2x + 120 & -x\text{-int } (y=0) &= 60 \\ y &= -\frac{2}{3}x + 40 \end{aligned}$$

- Equilibrium change from E to F, P_y decrease. It means that consumer consume less x but more y
 $\therefore x$ and y are substitute product
- Slope/Relative price decreases from $-\frac{1}{2}$ to $-\frac{2}{3}$
- Imaginary budget line still on the same IC

$$S.E. = \begin{cases} \Delta x = x_1 - x_0 = 27 - 31 = -4 < 0 \\ \Delta y = y_1 - y_0 = 18 - 15 = 3 > 0 \end{cases}$$

• Then move imaginary budget line up to New IC

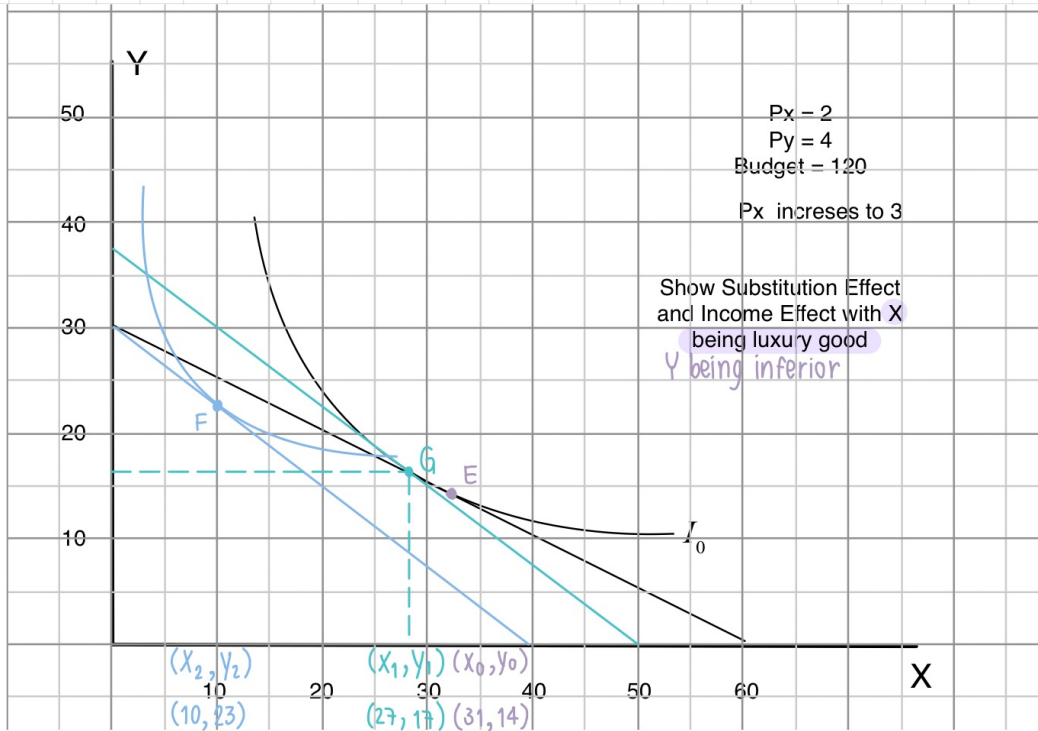
$$I.E. = \begin{cases} \Delta x = x_2 - x_1 = 23 - 27 = -4 < 0 \\ \Delta y = y_2 - y_1 = 24 - 18 = 6 > 0 \end{cases}$$

→ Consume less x but more y
 x is inferior, y is luxury
 \therefore more real income.

• Total Effects = S.E. + I.E

$$\begin{aligned} T.E. = \Delta x &= x_2 - x_1 = 23 - 31 = -8 \\ \Delta y &= y_2 - y_1 = 24 - 15 = 9 \end{aligned}$$

2.



• Old

$$\begin{aligned}
 XP_x + YP_y &= B \\
 2X + 4Y &= 120 \\
 4Y &= -2X + 120 \\
 Y &= -\frac{1}{2}X + 30
 \end{aligned}$$

• New

$$\begin{aligned}
 XP_x + YP_y &= B \\
 3X + 4Y &= 120 \\
 4Y &= -3X + 120 \\
 Y &= -\frac{3}{4}X + 30
 \end{aligned}$$

y-intercept ($x=0$) = 30
 x-intercept ($y=0$) = 40

- Equilibrium move from E to F, P_x increase. Means the consumer consume less x but more Y.
- Slope/Relative price decreases from $-\frac{1}{2}$ to $-\frac{3}{4}$
- Imaginary budget line on the same IC

$$\text{S.E.} = \begin{cases} \Delta X = X_1 - X_0 = 27 - 31 = -4 < 0 \\ \Delta Y = Y_1 - Y_0 = 17 - 14 = 3 > 0 \end{cases}$$

- New imaginary budget line shift up \rightarrow New IC
- $$\text{I.E.} = \begin{cases} \Delta X = X_2 - X_1 = 10 - 27 = -17 < 0 \\ \Delta Y = Y_2 - Y_1 = 23 - 17 = 6 > 0 \end{cases}$$
- } Consume less X but more Y
 } X is luxury, Y is inferior.
 } \therefore less real income

• Total Effect = S.E. + I.E.

$$\begin{aligned}
 \text{T.E.} = \Delta X &= X_2 - X_0 = 10 - 31 = -21 \\
 \Delta Y &= Y_2 - Y_1 = 23 - 14 = 9
 \end{aligned}$$