2.

Max $U = f(X,Y) = X^{\frac{2}{3}} Y^{\frac{1}{3}}$

Subject to $300 = 10X + 20Y$

$X = 20$, $Y = 5$

奶茶 提高 20元

Max $U = f(X,Y) = X^{\frac{2}{3}} Y^{\frac{1}{3}}$

subject to $300 = 20X + 20Y$

$MRS_{XY} = \frac{2Y}{X} = \frac{P_X}{P_Y} = 1$

得 $Y = \frac{1}{2} X$

$X = 10$, $Y = 5$

總效用
$$U = X^{\frac{2}{3}} Y^{\frac{1}{3}} = (20)^{\frac{2}{3}} (5)^{\frac{1}{3}} = (2000)^{\frac{1}{3}}$$

$Y = \frac{1}{2} X$ 代入 $U = (2000)^{\frac{1}{3}}$

$$U = X^{\frac{2}{3}} Y^{\frac{1}{3}} = \left[\frac{1}{2} X^3 \right]^{\frac{1}{3}} = (2000)^{\frac{1}{3}}$$

$X = (4000)^{\frac{1}{3}} \approx 15.87401$, $Y = (500)^{\frac{1}{3}}$

① 替代效果：由 $(X,Y) = (20,5)$ 到 $\left((4000)^{\frac{1}{3}}, (500)^{\frac{1}{3}} \right)$

X 的 替代效果 $= (4000)^{\frac{1}{3}} - 20 < 0$

② 所得效果：由 $(X,Y) = \left((4000)^{\frac{1}{3}}, (500)^{\frac{1}{3}} \right)$ 至 $(10,5)$