1-)

	diameter	Cost per wafer	Dies per wafer	Defects / cm^2
Wafer_X	16cm	15	64	0,02
wafer_Y	20cm	24	100	0,03

$(\pi = 3,14)$

A) Wafer_X:

$R = 16 \quad r = 8 \qquad \text{wafer area} = \pi r^2 = \boxed{64\pi cm^2} = \boxed{200.96 cm^2}$

$$\text{die area} \approx \frac{\text{Wafer area } cm^2}{\text{dies per wafer}} \approx \frac{64\pi}{64} = \boxed{3,14 cm^2}$$

Wafer_Y:

$R: 20 \quad r = 10 \qquad \text{wafer area} = \pi r^2 = \boxed{100\pi cm^2} = \boxed{314 cm^2}$

$$\text{die area} \approx \frac{\text{wafer area}}{\text{dies per wafer}} \approx \frac{100\pi cm^2}{100} \approx \boxed{3,14 cm^2}$$

B) $(\pi = 3,14)$

wafer_X:

$$\text{yield} = \frac{1}{\left(1 + \left(0,02 \times \frac{3,14}{2}\right)\right)^2} = \frac{1}{(1 + (0,0314))^2} \Rightarrow$$

$$\Rightarrow \frac{1}{(1,0314)^2} = \frac{1}{1,063} = \boxed{0,94}$$

$$\text{cost per die} = \frac{15}{64 \times 0,94} = \boxed{0,249}$$

wafer_y:

$$\text{yield} = \frac{1}{\left(1 + \left(0,03 \times \frac{3,14}{2}\right)\right)^2} = \frac{1}{(1 + (0,047))^2} = \frac{1}{1,096} \Rightarrow$$

$$\Rightarrow \frac{1000}{1096} = \boxed{0,91}$$

$$\text{cost per die} = \frac{24}{100 \times 0,91} = \frac{24}{91} = \boxed{0,263}$$

c) Wafer X:

New values:

Dies per wafer $= 64 \cdot \frac{110}{100} = 70{,}4$

Defects / cm^2 $= 0{,}02 \cdot \frac{115}{100} = 0{,}023$

Cost Per wafer $= 15 \cdot \frac{80}{100} = 12$

$$\text{new yield} = \frac{1}{\left(1 + \left(0{,}023 \cdot \frac{2{,}8545}{2}\right)\right)^2} = \boxed{0{,}9374}$$

wafer area $= 200{,}86 \text{ cm}^2$

Die area $= \frac{200{,}86}{70{,}4} = \boxed{2{,}8545 \text{ cm}^2}$

cost per die $= \frac{12}{70{,}4 \times 0{,}9374} = \boxed{0{,}1818}$

cost per die		
before	>	new
0,249	>	0,1818

decreased cost %36

Wafer Y:

New Values:

Dies per wafer $= 100 \cdot \frac{110}{100} = 110$

Defects /cm^2 $= 0{,}03 \cdot \frac{115}{100} = 0{,}0345$

Cost Per wafer $= 24 \cdot \frac{80}{100} = 18{,}2$

$$\text{new yield} = \frac{1}{\left(1 + \left(0{,}0345 \times \frac{2{,}8545}{2}\right)\right)^2} = \boxed{0{,}9083}$$

wafer area $= 314 \text{ cm}^2$

Die area $= \frac{314}{110} = \boxed{2{,}8545}$

cost per die $= \frac{19{,}2}{110 \cdot 0{,}9083} = \boxed{0{,}1921}$

cost per die		
before		new
0,263	>	0,1921

decreased cost %36

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2-)

$P1 = 3GHz$ $P2 = 1.5GHz$

$I = 1$ billion

%30 R-Type %50 I-Type %20 J-Type

Required Cycles	R-Type	I-Type	J-Type
P1	2	4	3
P2	3	3	3

A) $P1: 1\times10^{\cancel{9}\,8} \cdot \frac{3}{\cancel{10}} \cdot 2 + 1\times10^{\cancel{9}\,8} \cdot \frac{5}{\cancel{10}} \cdot 4 + 1\times10^{\cancel{9}\,8} \cdot \frac{2}{\cancel{10}} \cdot 3 \Rightarrow$

$\Rightarrow 6\times10^{8} + 20\times10^{8} + 6\times10^{8} \Rightarrow \boxed{32\times10^{9}}$

$P2: 1\times10^{\cancel{9}\,8} \cdot \frac{3}{\cancel{10}} \cdot 3 + 1\times10^{\cancel{9}\,8} \cdot \frac{5}{\cancel{10}} \cdot 3 + 1\times10^{\cancel{9}\,8} \cdot \frac{2}{\cancel{10}} \cdot 3 \Rightarrow$

$\Rightarrow 9\times10^{8} + 15\times10^{8} + 6\times10^{8} \Rightarrow \boxed{3\times10^{9}}$

B) P1:

$1\times10^{9} \cdot \frac{3}{10} \cdot 2 + 1\times10^{9} \cdot \frac{5}{10} \cdot 4 + 1\times10^{9} \cdot \frac{2}{10} \cdot 3 \Rightarrow$

$\Rightarrow 0{,}6\times10^{9} + 2\times10^{9} + 0{,}6\times10^{9} \Rightarrow \boxed{3{,}2\times10^{9} \text{ total cycles}}$

avg CPI for P1 $\Rightarrow \frac{3{,}2\times\cancel{10^{9}}}{1\times\cancel{10^{9}}} = \boxed{3{,}2}$

P2:

$1\times10^{9} \cdot \frac{3}{10} \cdot 3 + 1\times10^{9} \cdot \frac{5}{10} \cdot 3 + 1\times10^{9} \cdot \frac{2}{10} \cdot 3 \Rightarrow$

$\Rightarrow 0{,}9\times10^{9} + 1{,}5\times10^{9} + 0{,}6\times10^{9} \Rightarrow \boxed{3\times10^{9} \text{ total cycles}}$

avg CPI for P2 $= \frac{3\times\cancel{10^{9}}}{1\times\cancel{10^{9}}} = \boxed{3}$

c) P1: CPI: 3,2 3GHz # of instruction 1×10^9

$3{,}2 \times 1 \times 10^9 = 3{,}2 \times 10^9$ billion clock cycle

$t_1 = \frac{3{,}2 \times \cancel{10^9}}{3 \times \cancel{10^9}} \Rightarrow \frac{3{,}2}{3} s \Rightarrow \boxed{1{,}07 \text{ s}}$

P2; CPI: 3 1,5GHz # of instruction 1×10^9

$3 \times 1 \times 10^9 = 3 \times 10^9$ billion clock cycle

$t_2 = \frac{3 \times 10^9}{1.5 \times 10^9} = \boxed{2s}$

D) P1 is 1,86 times faster than P2

$\frac{2 \cancel{s}}{1{,}07 \cancel{s}} = 1{,}86$

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