1. M2 is 100% faster than M1 on program 1.
M1 is 33% faster than M2 on program 2.

2.

$$\text{MIPS}_{\text{M1}} = \frac{200}{10} = 20$$
$$\text{MIPS}_{\text{M2}} = \frac{160}{5} = 32$$

3.

$$\text{Time} = \text{CPI} * \text{Instructions} * \frac{1}{\text{Clock Rate}}$$

$$10 = \text{CPI}_{\text{M1}} * 200 * 10^6 * \frac{1}{200 * 10^6}$$
$$\text{CPI}_{\text{M1}} = 10$$

$$5 = \text{CPI}_{\text{M2}} * 160 * 10^6 * \frac{1}{300 * 10^6}$$
$$9.375 = \text{CPI}_{\text{M2}}$$

4.

$$\text{Time} = \text{CPI} * \text{Instructions} * \frac{1}{\text{Clock Rate}}$$

$$3 = 10 * \text{Instructions}_{\text{M1}} * \frac{1}{200 * 10^6}$$
$$60 * 10^6 = \text{Instructions}_{\text{M1}}$$

$$4 = 9.375 * \text{Instructions}_{\text{M2}} * \frac{1}{300 * 10^6}$$
$$128 * 10^6 = \text{Instructions}_{\text{M2}}$$

5.

$$\frac{\text{Cost}_{\text{M2}}}{\text{Cost}_{\text{M1}}} = \frac{15000}{10000} = 1.5$$
$$\frac{\text{Time}_{\text{M1}}}{\text{Time}_{\text{M2}}} = \frac{10}{5} = 2$$
$$\frac{\text{Cost}_{\text{M2}} * \text{Time}_{\text{M2}}}{\text{Cost}_{\text{M1}} * \text{Time}_{\text{M1}}} = 1.33$$

I would buy M2 in bulk because it is 100% faster than M1, and its only 50% more expensive than M1. so the cost/preformance is 33% better with M2.

6.

$$\text{MIPS}_{\text{peak-M1}} = 500 \div 1$$
$$\text{MIPS}_{\text{peak-M2}} = 750 \div 2 = 375$$

7.

$$\text{Time}_{\text{M1}} = 2.5 * 200 * 10^6 * \frac{1}{500 * 10^6} = 1$$
$$\text{Time}_{\text{M2}} = 3 * 160 * 10^6 * \frac{1}{750 * 10^6} = .64$$
$$\frac{1}{.64} = 1.56$$

M2 is 56% faster than M1.

8.

$$.64 = 2.5 * 200 * 10^6 * \frac{1}{\text{Clock Rate}}$$
$$\text{Clock Rate} = 781.25\text{MHz}$$

9.

a)

$$\text{MIPS}_{\text{MNFP}} = \frac{1000}{2} = 500$$
$$\text{MIPS}_{\text{MFP}} = \frac{1000}{.1 * 6 + .15 * 4 + .05 * 20 + .7 * 2} = \frac{1000}{3.6} = 277$$

b)

$$\text{Instructions} = 300(.1 * 30 + .15 * 20 + .5 * 50 + .7)$$
$$= 9510\text{million instructions}$$

c)

$$\begin{aligned} \text{Time}_{\text{MFP}} &= \frac{300}{277} \\ &= 1.08 \end{aligned}$$

$$\begin{aligned} \text{Time}_{\text{MFP}} &= \frac{9510}{500} \\ &= 19 \end{aligned}$$