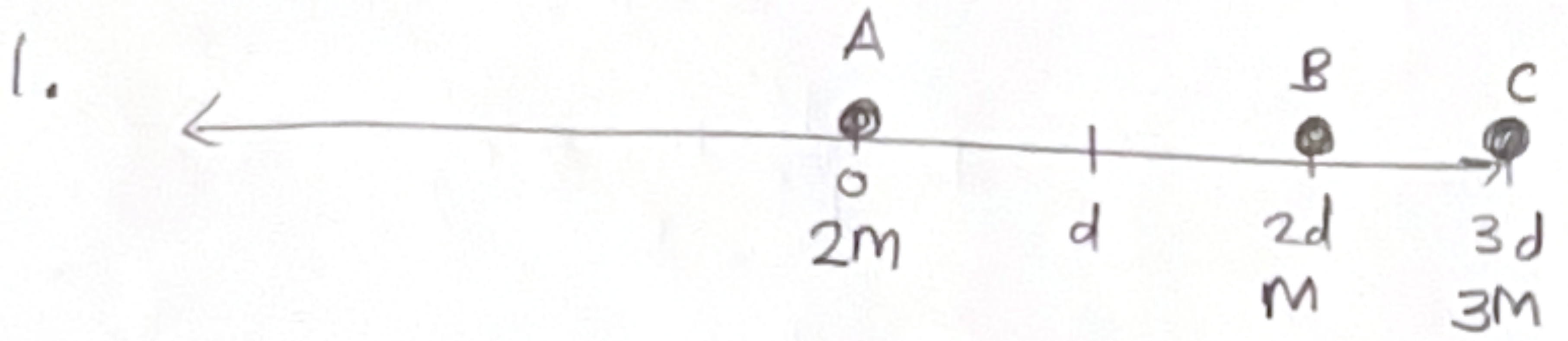
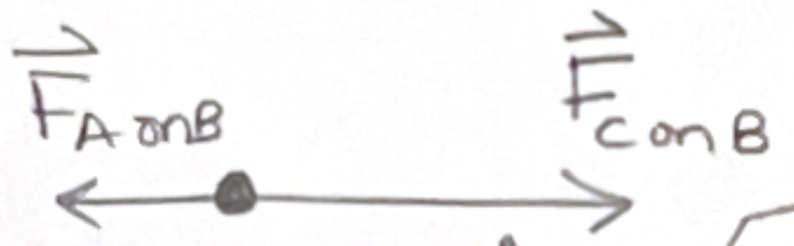
Force + motion 3

1.



a.



I know $\vec{F}_{C\,on\,B}$ has greater magnitude than $\vec{F}_{A\,on\,B}$ because C has greater mass than A, and it is closer to B than A.

b. Force on B due to C:

$$F_{C\,on\,B_x} = +G\frac{m_B m_C}{(r_{BC})^2} = +\frac{GM(3M)}{d^2} = +3GM^2/d^2$$

X-scalar component of $\vec{F}_{C\,on\,B}$

Force on B due to A:

$$F_{A\,on\,B_x} = -\frac{G m_A m_B}{(r_{AB})^2} = -\frac{G(2M)(M)}{(2d)^2} = -\frac{2GM^2}{4d^2} = -\frac{1}{2}\frac{GM^2}{d^2}$$

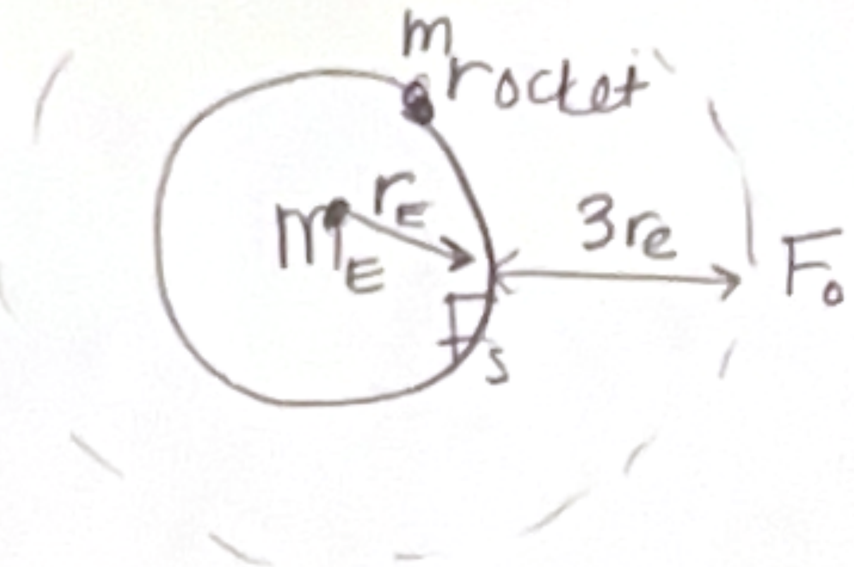
X-scalar component of $\vec{F}_{A\,on\,B}$

$$\Sigma F_{on\,B\,x} = F_{C\,on\,B\,x} + F_{A\,on\,B\,x} = +\frac{3GM^2}{d^2} - \frac{1}{2}\frac{GM^2}{d^2} = \boxed{\frac{5}{2}\frac{GM^2}{d^2}}$$

Add the scalar components to find $\Sigma F_{on\,Bx}$

Express the answer as a vector: The sum of the forces is $\left(\frac{5}{2}\frac{GM^2}{d^2}, +x\text{-direction}\right)$

2)



$$F = \frac{G m_1 m_2}{r^2}$$

$$F_s = \frac{G m_e m_r}{r_e^2}$$

$$F_o = \frac{G m_E m_r}{(4r_e)^2}$$

$$F_o = \frac{1}{16}\left(\frac{G m_E m_r}{r_e^2}\right)$$ The thing in parentheses is F_s!

$$F_o = \frac{1}{16} F_s$$

So the ratio $F_s / F_o = \boxed{16/1}$

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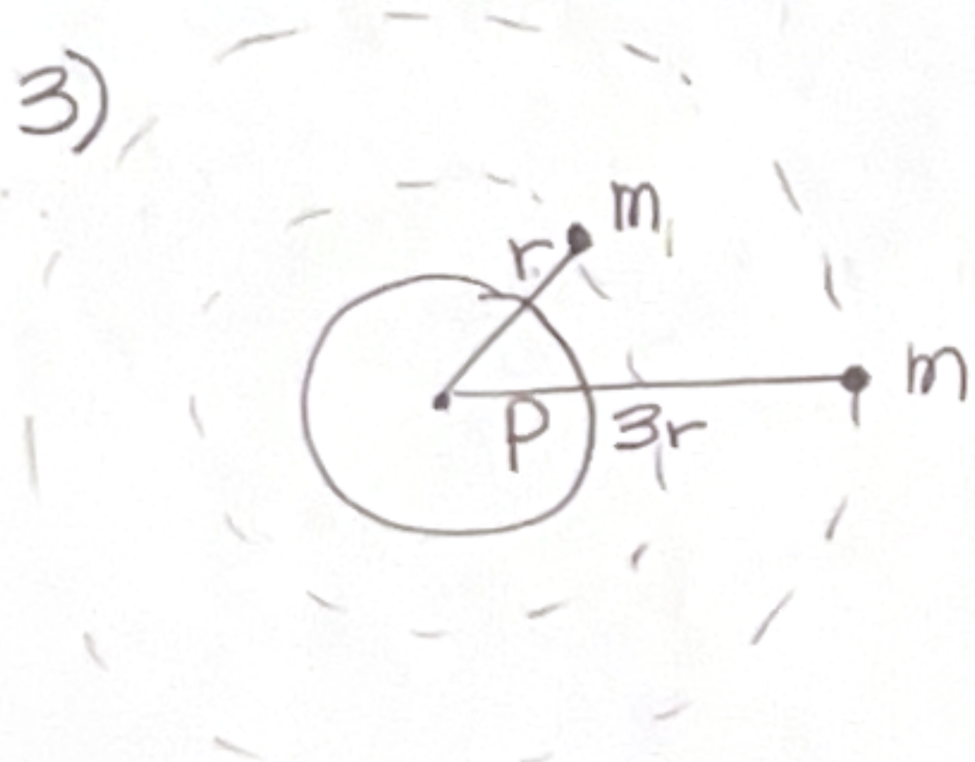
3)



$$F = \frac{G m_1 m_2}{r^2}$$ general equation

$$F_{p \text{ on } 1} = \frac{G m_p m}{r^2}$$ situation 1

$$F_{p \text{ on } 2} = \frac{G m_p m}{(3r)^2}$$ situation 2

$$F_{p \text{ on } 2} = \frac{1}{9}\left(\frac{G m_p m}{r^2}\right)$$

$$F_{p \text{ on } 2} = \frac{1}{9}\left(F_{p \text{ on } 1}\right)$$ situation 2 expressed in terms of situation 1

So, the ratio $\frac{F_{p \text{ on } 2}}{F_{p \text{ on } 1}} = \boxed{\frac{1}{9}}$

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4) Since $g = \frac{G m_{Agent}}{r^2}$, $\boxed{\text{A and C}}$ will affect g.

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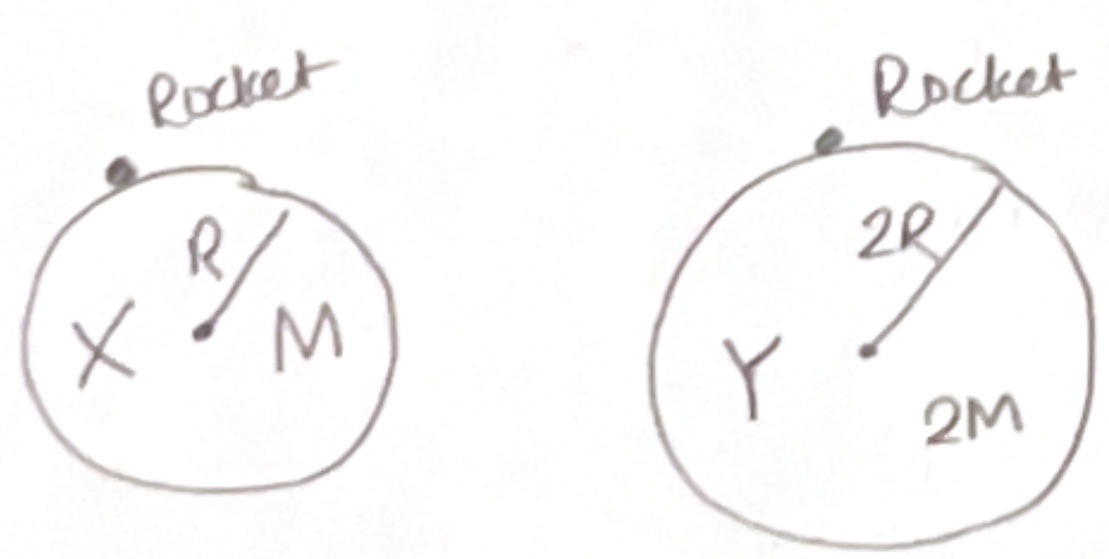
5)



g_1 g_2

$$g = \frac{GM}{r^2}$$

$$\text{factor of change} = \frac{(1)(2)}{(2)^2}$$

$$= \boxed{\frac{1}{2}}$$

6) The mass of the rocket does not have any effect on the gravitational field of the planet, so my answer is still $\frac{1}{2}$. It doesn't change.