1. (c) 
\[ T = mg = 10 \times (9.8) = 98 \text{ N} \]

3. (b) 
Here \( T_1 - T_2 = 6a \) 
\[ T_2 - 1g = 1a \text{ and } 3g - T_1 = 3a \]

Addition of the above three equations give 
\[ 10a = 3g - 1g = 2g \]

4. (b) 
Three force of 100 N acts on both the boats
\[ \therefore 250a_1 = 100 \text{ and } 500a_2 = 100 \]
Or \[ a_1 = 0.4 \text{ ms}^{-2} \]
And \[ a_2 = 0.2 \text{ ms}^{-2} \]
Then relative acceleration
\[ = a_1 + a_2 = 0.6 \text{ ms}^{-2} \]
Using \[ S = ut + \frac{1}{2}at^2 \], we get
\[ 100 = (1/2) \times 0.6 \times t^2 \]
Or \[ t = 18.3 \text{ s.} \]

5. (c) 
Acceleration of mass \( m \) is
\[ a = \sqrt{a_x^2 + a_y^2} \]
Various force equations are
\[ 2T - N = Ma_x \]
\[ N = ma_x \]
And \[ mg - \mu N - T = ma_y \]
Solving \[ a_x = \frac{2mg}{M + 5m + 2\mu m} \]
And \[ a_y = \frac{4mg}{M + 5m + 2\mu m} \]
\[ \therefore a = \sqrt{a_x^2 + a_y^2} = \frac{2\sqrt{5mg}}{M + 5m + 2\mu m} \]
6. (b) For equilibrium
\[ T = m_1 a \]  \hspace{1cm} \text{... (i)}
And \[ T = m_2 g + \mu m_2 a \]  \hspace{1cm} \text{... (ii)}

From (i) and (ii)
\[ m_1 a = m_2 g + \mu m_2 a \]
Or
\[ \mu = \frac{m_1 a - m_2 g}{m_2 a} \]
\[ = \frac{m_1 \left( \frac{g}{7} \right) - m_2 g}{m_2} = \frac{m_1 - 7m_2}{7m_2} \]

7. (a) Here \[ T_1 = T_2 \cos 30 \text{ } T_2 \frac{\sqrt{3}}{2} \]
i.e., \[ T_2 = \frac{2}{\sqrt{3}} T_1 \]
also \[ Mg = T_2 \sin 30^\circ = \frac{T_1}{2} \]
i.e., \[ Mg = \frac{2}{\sqrt{3}} \frac{T_1}{2} = \frac{T_1}{\sqrt{3}} \]
i.e., \[ T_1 = \sqrt{3} Mg \]

8. (a)

9. (b) Impulse = Ft = change in momentum
\[ = mu - (-mu) \]
\[ = 2mu = 2 \times 0.01 \times 5 \]
\[ = 0.1 \]
\[ \therefore F = \frac{0.1}{0.01} = 10 \text{ N} \]

10. (a)
\[ f_{\text{max}} \text{ for } A = \mu_1 \left( mg \cos 45^\circ \right) \]
\[ = \frac{2 \text{ mg}}{3 \sqrt{2}} = \frac{\sqrt{2}}{3} \text{ mg} \]
Also $f_{\text{max}}$ for $B = \mu (2mg \cos 45)$

\[
= \frac{1}{3} \left(2mg \sqrt{2}\right) = \frac{\sqrt{2}}{3} \frac{mg}{3}
\]

Total frictional force

\[
= \frac{\sqrt{2}}{3} \times mg + \frac{\sqrt{2}}{3} \times mg = \frac{2\sqrt{2}}{3} \frac{mg}{3}
\]

But pulling force

\[
F_1 - F_2 = \frac{2mg}{\sqrt{2}} - \frac{mg}{\sqrt{2}} = \frac{mg}{\sqrt{2}}
\]

∴ system can be accelerate.

11. (a, c)

\[a = mg - T\]

\[T = 3\text{solving } a = \frac{g}{4}\]

∴ $T = \frac{3g}{4}$ and $F_{\text{clamp}} = \sqrt{2} \frac{3g}{4}$

18. (d)

\[2T \sin \phi = Mg\]

\[T = \frac{Mg}{2 \sin \phi} = \frac{900}{2 \sin 10}\]

\[T = \frac{450}{0.1736} = 2580 \text{ N}\]

19. (a)

\[\sin \phi = \frac{Mg}{2T} = \frac{900}{2 \times 25000} = .018\]

Or $\phi = 1^\circ$

20. $a_{rel} = a_A - a_B = 2 \text{ms}^{-2}$

\[s = \frac{1}{2} a_{rel} t^2, \quad t = \sqrt{\frac{4 \times 2}{2}} = 2 \text{s}\]