

① ② 20 N

② $m = 5 \text{ kg}, a = g = 10 \text{ m/s}^2$

Force pulling on roof is

$$F = ma = mg$$

$$F = 50 \times 10 = 500 \text{ N}$$

③ Total $m = 50 + 5 = 55 \text{ kg}$

$$a = g = 10 \text{ m/s}^2$$

$$F = ma = mg$$

$$F = 55 \times 10 = 550 \text{ N}$$

② (a) Let $N = T$

$$a = 1.2 \text{ m/s}^2$$

$$m = 50 \text{ g} = \frac{50}{1000} \text{ kg}$$

$$N - mg = ma$$

$$T = m(g + a)$$

$$T = \frac{50}{1000} (9.8 + 1.2) = 0.55 \text{ N}$$

b) $a_x = -1.2 \text{ m/s}^2$ (upward)
 $T = m(g + (-a_x))$

$$T = \frac{50}{1000} (9.8 - 1.2) = 0.43 \text{ N}$$

c) $a = 0$ as $v = \text{const.}$

$$T = \frac{50}{1000} \times 9.8 = 0.49 \text{ N}$$

d) acceleration after downward $T = m(g - a)$

$$T = \frac{50}{1000} (9.8 - 1.2) = 0.43 \text{ N}$$

e) a_x downward $= -1.2 \text{ m/s}^2$

$$T = \frac{50}{1000} (9.8 - (-1.2)) = 0.55 \text{ N}$$

f) $v = \text{constant}$ so, $a = 0$

$$T = \frac{50}{1000} \times 9.8 = 0.49 \text{ N}$$

g) Mass of monkey = 40 kg

It can stand maximum tension of 600 N

$$T_{\text{max}} = 600 \text{ N}$$

h) Climbs up with $a = 4 \text{ m/s}^2$, $T - mg = ma \Rightarrow 40(10 + 4)$
 $T = 640 \text{ N}$, $T_{\text{max}} < T$: the rope will break

b) $a = 4 \text{ m/s}^2$ downward

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$$mg - T = ma$$

$$T = m(g - a)$$

$$\Rightarrow 40(10 - 4)$$

$\Rightarrow 240 \text{ N}$, $T_{\text{max}} > T \therefore$ the rope will not break.

c) Climb up with uniform speed $= 5 \text{ m/s} \therefore a = 0$

$$T - mg = ma$$

$$T - mg = 0$$

$T = mg = 40 \times 10 = 400 \text{ N}$, $T_{\text{max}} > T \therefore$ the rope will not break

d) When the monkey falls freely $\therefore a = g = 10 \text{ m/s}^2$

$$mg - T = mg$$

$$T = m(g - g) = 0$$

$T_{\text{max}} > T \therefore$ the rope will not break.