Chapter 4

Problems & Exercises

1.

265 N

3.

13.3 m/s^2

7.

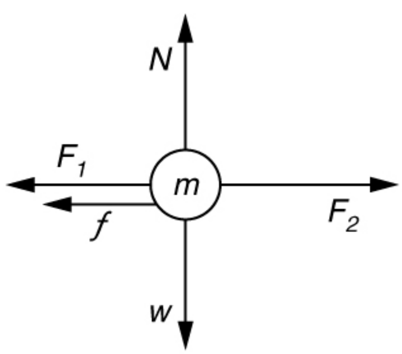
(a) 12 m/s^2.

(b) The acceleration is not one-fourth of what it was with all rockets burning because the frictional force is still as large as it was with all rockets burning.

9.

(a) The system is the child in the wagon plus the wagon.

(b)



(c) $a = 0.130\ \text{m/s}^2$ in the direction of the second child's push.

(d) $a = 0.00\ \text{m/s}^2$

11.

(a) $3.68 \times 10^3\ \text{N}$. This force is 5.00 times greater than his weight.

(b) 3750 N; 11.3º above horizontal

13.

$1.5 \times 10^3\ \text{N}, 150\ \text{kg}, 150\ \text{kg}$

15.

Force on shell: 2.64×10^7 N

Force exerted on ship = -2.64×10^7 N, by Newton's third law

17.

a. $0.11\ \text{m/s}^2$
b. 1.2×10^4 N

19.

(a) 7.84×10^{-4} N

(b) 1.89×10^{-3} N . This is 2.41 times the tension in the vertical strand.

21.

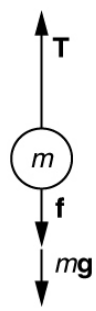
Newton's second law applied in vertical direction gives

$F_y = F - 2T\ \sin\ \theta = 0$

$F = 2T\ \sin\ \theta$

$T = \frac{F}{2\ \sin\ \theta}$.

23.



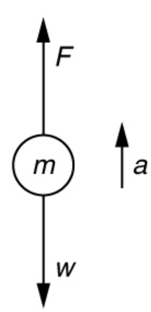
Using the free-body diagram:

$F_{\text{net}} = T - f - mg = \text{ma}$,

so that

$a = \frac{T-f-\text{mg}}{m} = \frac{1.250\times10^7\ \text{N}-4.50\times10^6\ N-(5.00\times10^5\ \text{kg})(9.80\ \text{m/s}^2)}{5.00\times10^5\ \text{kg}} = 6.20\ \text{m/s}^2$.

25.



1. Use Newton's laws of motion.

2. Given : $a = 4.00g = (4.00)(9.80\ \text{m/s}^2) = 39.2\ \text{m/s}^2$; $m = 70.0$ kg,

- Find: F.

3. $\sum F{=}{+}F - w = \text{ma}$, so that $F = \text{ma} + w = \text{ma} + \text{mg} = m(a + g)$.

- $F = (70.0\ \text{kg})[(39.2\ \text{m/s}^2) + (9.80\ \text{m/s}^2)] = 3.43 \times 10^3\text{N}$. The force exerted by the high-jumper is actually down on the ground, but F is up from the ground and makes him jump.

4. This result is reasonable, since it is quite possible for a person to exert a force of the magnitude of 10^3 N.

27.

(a) 4.41×10^5 N

(b) 1.50×10^5 N

29.

(a) 910 N

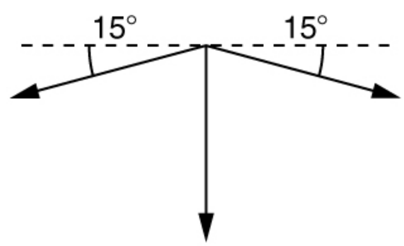
(b) 1.11×10^3 N

31.

$a = 0.139$ m/s, $\theta = 12.4$ north of east

33.

1. Use Newton's laws since we are looking for forces.



2. Draw a free-body diagram:

3. The tension is given as $T = 25.0$ N. Find F_{app}. Using Newton's laws gives: $\Sigma\ \text{F}_y = 0$, so that applied force is due to the y-components of the two tensions: $F_{\text{app}} = 2\ T\ \sin\ = 2(25.0\ \text{N})\sin(15^{\text{o}}) = 12.9$ N

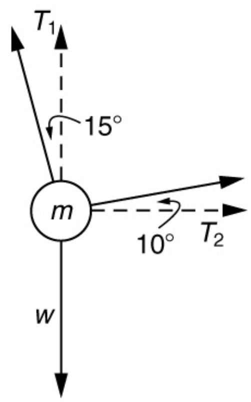
- The x-components of the tension cancel. $\sum F_x = 0$.

4. This seems reasonable, since the applied tensions should be greater than the force applied to the tooth.

40.

$10.2\ \text{m/s}^2$, 4.67^{o} from vertical

42.



$T_1 = 736$ N

$T_2 = 194$ N

44.

(a) 7.43 m/s

(b) 2.97 m

46.

(a) 4.20 m/s

(b) 29.4 m/s^2

(c) 4.31×10^3 N

48.

(a) 47.1 m/s

(b) 2.47×10^3 m/s^2

(c) 6.18×10^3 N . The average force is 252 times the shell's weight.

52.

(a) 1×10^{-13}

(b) 1×10^{-11}

54.

10^2

55.

(a) Box A travels faster at the finishing distance since a greater force with equal mass results in a greater acceleration. Also, a greater acceleration over the same distance results in a greater final speed.

(b) i. Yes, it is consistent because a greater force results in a greater final speed.
ii. It does not make sense because $V = \sqrt{2(f/m)x} = \mathrm{K}\sqrt{(F)}$.

(c)