6.E.23 If the fully dressed person were to become less dressed and toss the
removed clothing horizontally, conservation of momentum would
 guarante that the person would move in the opposite direction.

6.E.26 Before the engines are turned on, there is no net momentum. With stuff
shooting out the back, the rocket had better be moving in the other
direction if the total momentum is still going to be zero.

9.R.12 The force of gravity between two bodies grows as they grow nearer one
another. You would weigh more in Death Valley because you would be
closer to the center of the earth. (There are subtleties in this problem that
we are ignoring. For example, it may have occurred to you that when you
are on the mountain, you have more mass under you. This does add to
your weight, but my back-of-the-envelope calculation tells me that the
correction is on the order of a tenth of a percent.)

9.R.13 The force is never really zero! As you approach infinity, the force
vanishes, but in reality, our laws of gravity say that all massive objects
exert forces on all other massive objects.

9.E.3 If gravity disappeared, the moon would proceed with the velocity it had at
the moment that the force became zero. It would fly off on a line tangent
to its orbit.

9.E.9 An astronaut is certainly under the influence of gravity. They wouldn’t be
orbiting otherwise! The weightlessness is a result of the astronaut and the
space ship being in freefall. We usually have the ground to push up on us,
but if the floor is falling with you, you can’t feel weight.

9.E.14 With the same mass, the only change to the form of the force comes from
the change in radius. The force would be smaller for a larger radius; that
is, you would weigh less if Earth expanded. If it shrunk, you would weigh
more.

9.E.43 The orbit depends on the mass of the sun and our distance from it. Neither
changes in the scenario described.

9.P.7
(a) $F = \frac{Gm_1m_2}{r^2}$, we are given all of these numbers:

$F = (6.67 \times 10^{-11}\text{Nm}^2/\text{kg}^2)(3\text{kg})(6.4 \times 10^{-23}\text{kg})/(5.6 \times 10^{10}\text{m})^2 = 4.1 \times 10^{-8}\text{N}$
(b) Same idea here, but we have a different $m_2$ and $r$:

\[ F = (6.67 \times 10^{-11} \text{Nm}^2/\text{kg}^2)(3\text{kg})(100\text{kg})/(0.5)^2 = 8.0 \times 10^{-8} \text{N} \]

(c) The force between people is about the same as the force between Mars and a person on Earth—actually twice as much in this particular scenario. Makes you wonder what astrology is all about: how can it be important where Mars is when you’re born if your physician exerts more gravitational force on you than Mars?

10.R.15 The force acts in a direction perpendicular to the direction of motion, so it only changes the trajectory.

10.E.16 Yes, the space shuttle is accelerating. The acceleration points toward the Earth and is on the line connecting the shuttle and the center of the Earth.

35.E.6 You are also “moving through” time.

36.R.2 The two motions are identical.

36.R.7 The greater the gravitational force, the slower the passage of time. The clock on the shore of Lake Michigan runs more slowly because it is nearer the Earth.

36.E.2 What if the train were tilted (parked on a side-slope)? You would then be mashed into the wall a little bit, or a ball on a table would roll toward the side. This question highlights the similar “fictitious” nature of gravity and centrifugal force, as the initial assumption before realizing the train isn’t moving is that you’re going around a curve.