Chapter 5

Q4 The change in velocity is greater for the curve with the smaller radius. Since the distance and speed were the same for both cases, it comes down to comparing rate of change in angular direction.

Q13 The rider’s weight, (downward), is the largest force. The net force is toward the middle of the Ferris wheel; the net force must be the centripetal force.

\[ \text{mg} \]

\[ \text{N} \]

Q19 A planet in an elliptical orbit about the sun moves fastest when it is nearest the sun. This is because an equal area of the ellipse is traversed in the same time interval at both aphelion and perihelion (as well as for points in between).

Q23 Since the gravitational force of attraction varies as \( 1/r^2 \), doubling the distance between them will result in \( 1/4 \) of the original force acting between them.

Q31 Because the moon moves relative to the Earth it takes about 25 hours for the moon to return to the same point in the sky, so there are two high tides every 25 hours.

E6  
a. 10.0 m/s\(^2\)  
b. 12 kN

E8  
a. 5.33 m/s\(^2\)  
b. 373.3 N

E11  
0.04 N

E16  
a. 3:00 PM  
b. 8:47 AM, 9:12 PM

SP2  
a. 9.42 m/s  
b. 7.4 m/s\(^2\)  
c. 2.96 \times 10^2 N is the necessary centripetal force; Yes.  
d. 96 N  
e. If the rider lets go of the safety bar the rider will fly out at a trajectory tangent to the Ferris wheel’s rotation (parallel to the ground). At that moment gravity will also accelerate the rider to the ground.
a. $3.53 \times 10^{22}$ N
b. $2.01 \times 10^{20}$ N
c. 175/1. No – the earth’s orbit is much more strongly influenced by the sun than by the moon – by a factor of more than 2 orders of magnitude!
d. $4.34 \times 10^{20}$ N. Note that this force is comparable to the result from part b. The sun’s force keeps the moon in its annual orbit about the sun as it (the moon) moves along with the Earth.