$$F_g = \frac{Gm_1m_2}{r^2} \qquad F_c = \frac{mv^2}{r} \qquad a_c = \frac{v^2}{r}$$

Centripetal Acceleration

1. A customer sits in a revolving restaurant 11 m from the center. If the customer's tangential speed is 0.0192 m/s, how large a centripetal acceleration does the customer experience?

2. NASA uses large centrifuges to study the effects of large forces on astronauts prior to going into space. A subject in the 20-g centrifuge, which has a radius of 8.9 m, can have a centripetal acceleration as large as 20 ***times*** g, where g equals 9.8 m/s. What is the linear speed of the subject?

3. The Indianapolis Motor Speedway has four banked curves, each of which forms a quarter of a circle. Suppose a race car speeds along one of these curves with a constant tangential speed of 75.0 m/s. Neglecting the effects due to the banking of the curve, the centripetal acceleration on the car is 22.0 m/s^2. What is the radius of the curve?

4. A model electric train moves along a circular track. The train has a tangential speed of 0.35 m/s and has a centripetal acceleration of 0.29 m/s^2. What is the radius of the track?

Centripetal Force

5. Pat Kinch used a racing cycle to travel 21 m/s. Suppose Kinch moved at this speed around a circular track. If the combined mass of Kinch and the cycle was 92.0 kg and the average force that maintained his circular motion was 12.8 N, what was the radius of the track?

6. In 1992,a team of 12 athletes from Great Britain and Canada rappelled 446 m down the CN Tower in Toronto, Canada. Suppose an athlete with a mass of 75.0 kg, having reached the ground, took a joyful swing on the 446 m-long rope. If the speed of the athlete at the bottom point of the swing was 12 m/s, what was the tension in the rope? Neglect the rope's mass.

Gravity

7. The largest diamond ever found has a mass of 621g. If the force of gravitational attraction between this diamond and a person with a mass of 65.0 kg is 1.0×10^{-12} N, what is the distance between them?

8. The passenger liners Carnival Destiny and Grand Princess, have a mass of about 1.0×10^{8} kg each. How far apart must these two ships be to exert a gravitational attraction of 1.0×10^{-3} N on each other?

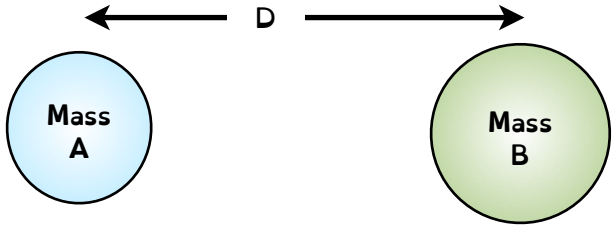
9. Jupiter, the largest planet in the solar system, has a mass 318 times that of Earth and a radius that is 36.4 times greater than Earth's. Calculate the magnitude of the gravitational force exerted on a 50.0 kg mass on Jupiter's surface.

10. In 1989, a cake with a mass of 5.81×10^{4} kg was baked in Alabama. Suppose a cook stood 25.0 m from the cake. The gravitational force exerted between the cook and the cake was 5.0 ×10−7N. What was the cook's mass?

Two masses are separated by a distance, and are attracted by a force of 60N. How much gravitational force will there be between the pairs of masses below?

$$G = 6.67x10^{-11}\frac{Nm^2}{kg^2}$$

$$F = \frac{GMm}{r^2}$$



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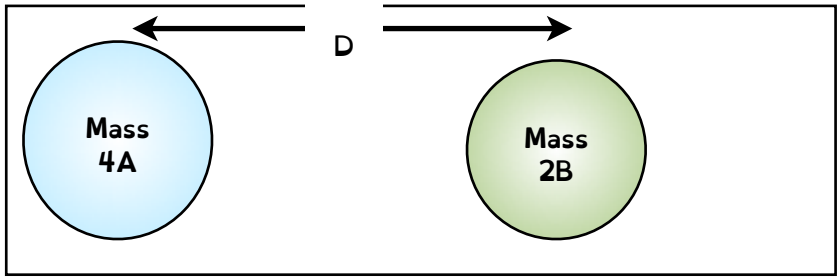

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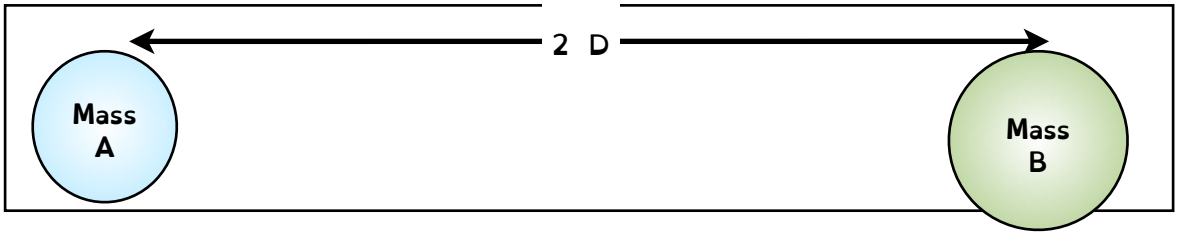

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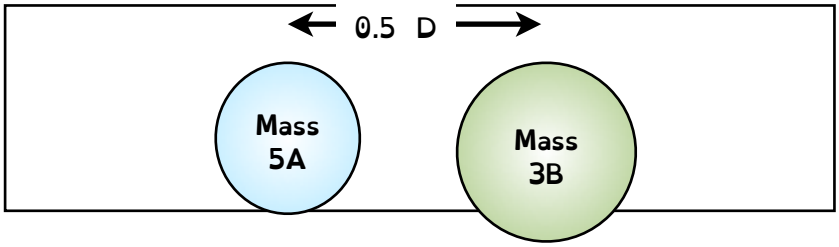

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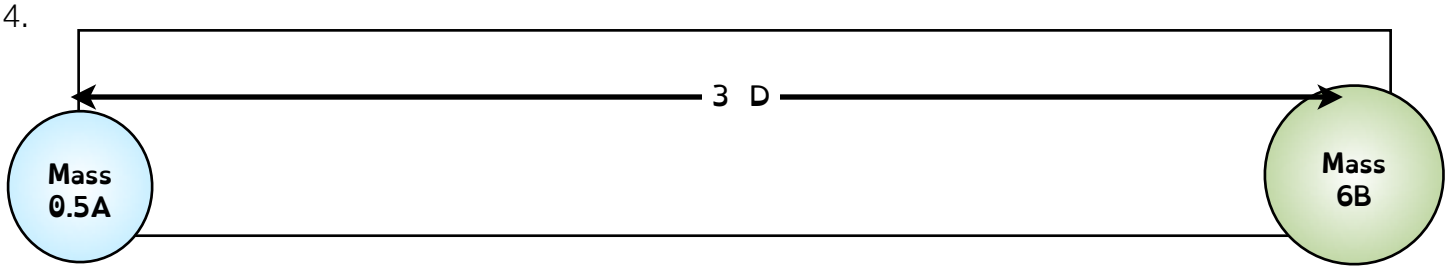


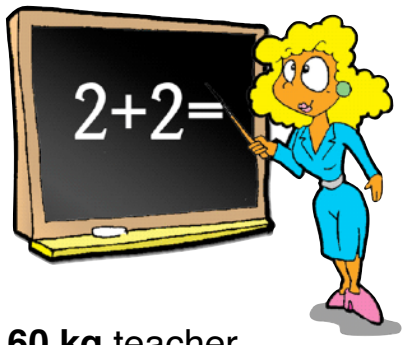
A Freshman boy sits in the middle of a classroom, his mass is 45kg. What is the force of gravitational attraction he feels towards the other 4 things in the room?

15. The Teacher _____

16. The Calculator _____

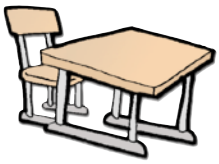
17. The Desk _____

18. The Girl _____



The **60 kg** teacher
2 m from the boy

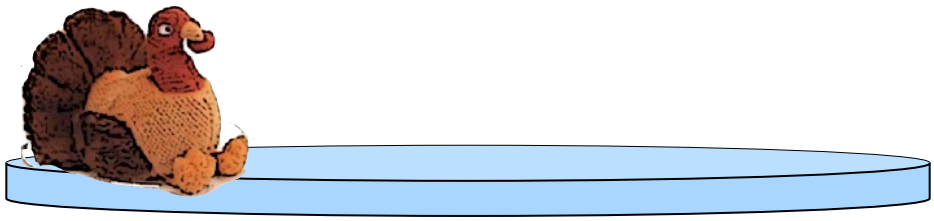
The **200 g** calculator
0.2 m from the boy



The **18 kg** desk
0.5 m from the boy

The **40 kg** girl
1 m from the boy

19. For more fun, a turkey (Mass = **11kg**) goes on a ride at the elementary school playground (radius = **2.3m**). Find the greatest velocity he can have if the coefficient of friction for the ride and the turkey is **0.55**.



V =

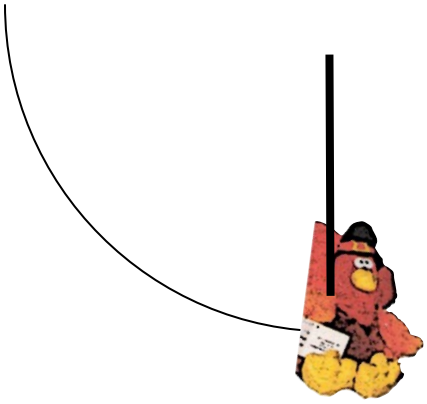
v =

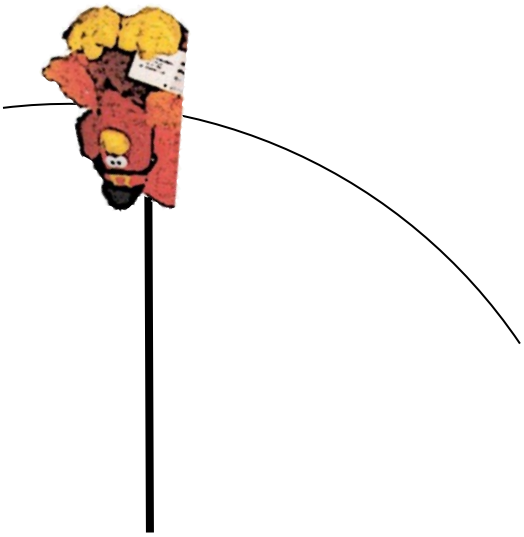
rev/min =

20. A turkey (mass = 6kg) is spinning around on an ice pond μ = 0, tied to a rope (length = 8m). How many times does the bird circle each minute, if the bird feels a centripetal acceleration of 5 g?

21. Mr. Gobbles (Mass = 4kg) is swinging from a rope (length = 2.3m). If at the bottom of the vertical circular path the speed of "Gobbles" is 5.9 m/s, find the tension in the rope.

T=





22. With the same string as in the previous question, what is the minimum speed to get "Gobbles" over the top?

Hint: What tension would be in the string if "Gobbles" just makes it around the circle?

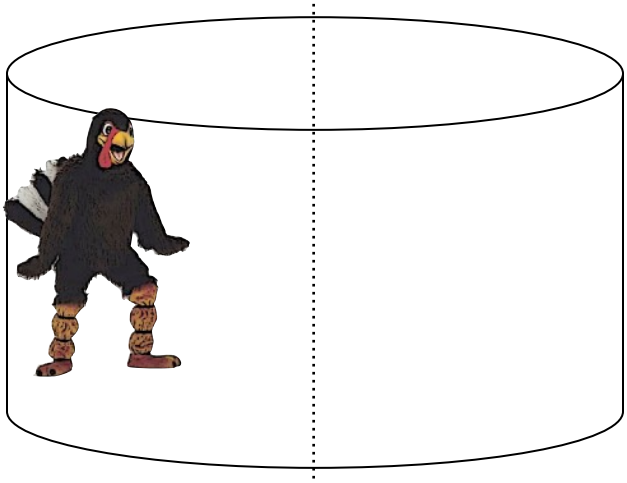
T_{min}=

v_{min}=

23. A strange man (m = **80 kg**) in a turkey costume goes on the Rotor ride (r = **3.2m**). As they lower the floor of the ride, the ride completes a turn every **4.1 s**. What is the necessary value of **μ** so that the turkey-man will not fall?

v =

μ_{min} =



24. This turkey (m = **10kg**) is on a safer ride at the amusement park. As the ride operates, the chain creates a **75°** angle with the ground, and a path with a **3.9m** radius. Find the tension in the chain, and the velocity of the turkey.

T =

V =