Chapter 9

1. Put F_1 along the x axis. Add the three y-components (which total 0) and solve for the y-component of F_3. Now add the x-components of all three vectors (which total 0) and solve for the x-component of F_3. Use the Pythagorean theorem to find F_3.

2. $\tau = F \perp d$ The diver's force is her weight.

3. Fixed pulleys serve only to change the direction of the force. Let the hop joint be the pivot for this problem. The clockwise torque due to the mass must equal the counterclockwise torque due to the weight of the leg.

4. Torque equals the diver's weight x distance from the pivot. List your variables and solve for distance.

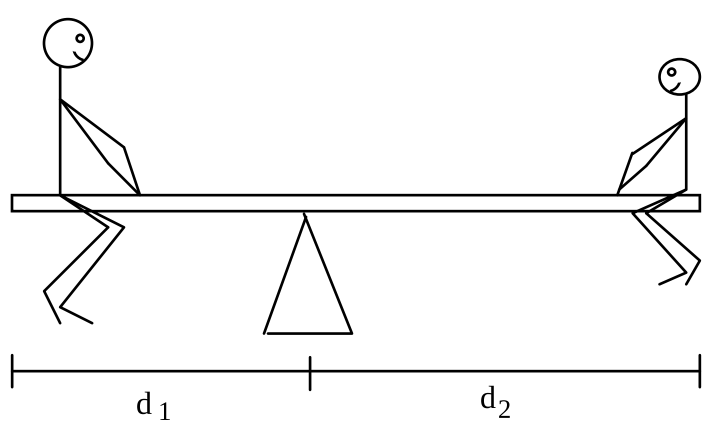
5. Figure 9-4 is on page 228 of the text along with a sample problem similar to this one. Set the tension of the cord attached to the ceiling to 1550 N and solve for the mass of the chandelier.

6. Add the vertical components of this problem and solve for F_A in terms of F_B. Set either support as the pivot, add the torques (a) ignoring the mass of the beam and (b) including the mass of the beam. Solve for the force that is not the pivot, and then for the pivot force using the first equation.

7. This problem is just like #8.

8. Add the forces, 2 up and 2 down. Solve for F_1 in terms of F_2. Now add the torques, using the left beam support (F_1) as the pivot. For distance from the pivot, use ½ L for the location of the center of mass of the beam, and ¼ L for the location of the center of mass of the piano. The L's will cancel and the fractions remain. Now solve for F_2. Once you have F_2, use your first equation to solve for F_1.

9. Find d_1 and d_2.



10. Figure 9-9 is on page 231. Add the vertical forces and solve for F_N.

11. You have two unknowns so you'll need 2 equations. Add the vertical components and solve for Fty. Use the sine function of Θ to solve for Ft_1. Use the cosine function of Θ to solve for Ftx. Then find Ft_2

12. Add the x components of the 2 tension forces. Solve for Ft_1 in terms of Ft_2. Add the y components and substitute Ft_1 with Ft_1 expressed in terms of Ft_2. Now solve for Ft_2. Use the value for Ft_2 to find Ft_1 using your first equation.

13. If the person exerts a maximum torque without tipping the table, the force on the far support will equal 0. The torque of the person at the edge of the table must equal the torque that the mass of the table exerts at the cg.

15. Add both up forces and all 4 (include the mass of the beam) down forces. Solve for F_1 in terms of F_2. Now add the torques, using F_1 (the left vertical support) as your pivot. Solve for F_2. Plug that into your first equation to solve for F_1.

16. Add the three torques and solve for the distance for the third child.

17. The sum of the torques from F_T and F_B will equal the total torque exerted on the rod. To find the force, divide the torque by the distance from the pivot to the rod.

18. If you make the y component of F_W the pivot point when you add the torques on the beam, you can get rid of that variable all together. Add the torques, using the y component of F_T as your vertical force at the end of the beam. Let the distance of F_{Ty} from the pivot be L, and the distance of the center of mass of the beam from the pivot be ½ L. Now solve for F_T.

19. Let the distance for the first torque be x, and the distance for the second torque be L-x. Add the torques and solve for x.

20. Add the torques placing the pivot at the wall. Solve for F_T. Add the vertical forces, including the weight of the beam and the y-component of the tension force. Solve for the y-component of the wall. Add the horizontal forces and solve for F_Wx

21. Add the vertical components of all three vertical forces and solve for the vertical force on the hinge. Add the horizontal components of both horizontal components. Choose the pivot at support A and add all three torques to solve for the tension force in the horizontal wire. Substitute that in the equation for horizontal forces and solve for the horizontal component of the force on the hinge.

26. Add both vertical forces and solve for the normal force on the floor. Add both horizontal forces and solve for the force of the wall (Fw). Remember, frictional force on a flat surface = $F_N\mu$. Choose the pivot at the floor and add the torques. Substitute for Fw and solve for Θ.

27. Add the torques and solve for the force of the wall. Add the horizontal forces and solve for the frictional force. Add the vertical forces and solve for the normal force. Now solve for the coefficient of friction.

30. Add the torques and solve for m_2. Convert cm to meters and Newtons to kilograms.

31. Add the torques and solve for F_M. Don't forget to include the torque from the mass of the arm itself.

47. a) Torque = force x perpendicular distance from the pivot.
    b) What exerts the force? In what direction?
    c) The top of the pole is pulling (tension), the bottom is resisting (compression) and the weight of the sign pulls straight down with a shear force.

48. Use the Table of ultimate strengths on page 258 and find the compressive strength of bone. Now use units. You want force, and you have compressive strength in N/m^2, and the area of the bone in m^2.

68. a) If the maximum weight is at point D, the force on vertical support A will be 0. The location of the center of mass of the beam is at the center of the beam. Use the information given to figure out how far that is from vertical support B. Now ΣFy must equal 0, and Σt must also equal 0. Solve for the maximum weight.

Chapter 10

1. The density of granite is given in Table 10-1 on page 256. $\rho = \frac{m}{V}$

2. The density of air is given in Table 10-1 on page 256. $\rho = \frac{m}{V}$

3. Density = mass/volume. Find the density of gold from Table 10-1 page 276 and calculate the volume of the gold in cubic meters. The calculate the mass.

5. $\rho = \frac{m}{V}$. The volumes are equal, so $\frac{m_1}{\rho_1} = \frac{m_2}{\rho_2}$. Solve for ρ_2.

7. $P = \frac{F}{A}$. Solve for pressure in each case and compare them.

8. Find the density of whole blood from Table 10-1 page 256 and use equation 10-3a on page 258 to find the pressure at 0 m and 1.60 m. Your answer will be in N/m^2. Convert N/m^2 to atmospheres and then atmospheres to mm-Hg see Table 10-2 on page 261.

10. $\Delta P = \rho g \Delta h$. Convert mm-Hg to atmospheres and solve for Δh.

12. See page 260. $\frac{F_{in}}{F_{out}} = \frac{A_{in}}{A_{out}}$

14. See equation 10-3c on page 261. $P = \rho gh$. P = absolute pressure.

17. $P = \rho gh$, where h is the vertical distance.
Gauge pressure is absolute pressure + atmospheric pressure.

18. $P = \rho gh$. Find the density of water on page 10-1 page 276.

22. See example 10-6 on page 284 and use the equation $\frac{\rho_o}{\rho_{H_2 0}} = \frac{w}{w - w^1}$ to find the density of the moon rock (ρ_o). w is the weight of the rock out in aif, and w^1 is the weight in water.

24. The tension on the steel cable will be the weight of the hull of the ship minus the buoyant force on it. The tension after it is lifted out of the water will be equal to the full weight of the hull of the ship.

25. The buoyant force on the cargo will equal the mg of the helium + mg of the balloon + mg of the cargo. Using the density of helium and the volume of the balloon, solve for the mass of the helium. Then solve for the mass of the cargo.

29. The volume of a sphere is: $V = \frac{4}{3} r^3$. The tension on the cable in this case will be the buoyant force on the sphere minus its weight.

36. See Example 10-12 on page 269.

38. See equation 10-6 on page 272. This is Toricelli's Theorem

39. See Example 10-12 on page 269. You're given the diameter of the hose so you can find the area, and the diameter and depth of the swimming pool so you can find it's volume. You also have velocity; solve for time.

42. The volume flow rate is from the continuity equation and is equal to the cross sectional area times the velocity of the fluid. Volume flow rate = A*v*. Find the cross-sectional area of the faucet (πR^2) and then the velocity of the fluid (Torecelli's Theorem).

43. There is negligible wind velocity below the roof and the thickness of the roof is negligible for this problem. You can use Bernoulli's equation, setting y_1, y_2 and $v_2 = 0$. Solve for pressure. Pressure = Force/area. Solve for force.

44. The thickness of the airplane wing is irrelevant so you can use Bernoulli's equation, setting y_1 and $y_2 = 0$ as in problem #39. Lift force on an airplane wing = ΔP x area. Rearrange Bernoulli's equation, solving for P_1-P_2. Then solve for force.

46. Pressures are gauge pressures. Convert to N/m^2 (see Table 10-2 page 281) and add $1.013 x 10^5$ to compensate for atmospheric pressure. Use the continuity equation (equation 10-4 page 288) to find the velocity on the top floor and then use Bernoulli's equation on page 290 to solve for pressure.

86. Let the weight of the plane be the lift force. Then use Bernoulli's Principle to calculate the velocity of the wind above the wings.