Homework Set 1

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Problem 1

- A sphere has a radius of 15 cm.
  - Find the length of the sides of a cube that has the same surface area as the sphere.
  - Find the length of the sides of a cube that has the same volume as the sphere.

Problem 2

- The magnitude M of an earthquake on the Richter scale is given by

$$M = \frac{2}{3} \log_{10}\left(\frac{E}{E_0}\right)$$

- Where E is the energy released and $E_0 = 10^{4.4}$ Joules

- Determine the ratios of the energies released for earthquakes of 6.9 and 7.1 on the Richter scale

Problem 3

- The power series for sin(x) is given by

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + ...$$

- The script on the next slide will compute this power series for a given value of x

- What causes the loop to terminate?

- How accurate is the series for x=π/2? How many terms were needed?

Script for Problem 3

```
function s=powersin(x)
s=0;
t=x;
n=1;
while s+t~=s
  s=s+t;
  t=-x.^2/((n+1)*(n+2)).*t;
  n=n+2;
end
```

Problem 4

- A ball is dropped from a height h of 2 meters.
- The velocity when it strikes the floor is given by $v^2=2gh$ and rebounds with a velocity that is 85% of the impact velocity.
- The ball then rebounds to a height of $h=v^2/2g$
- What is the height after the 8th bounce?

Problem 5

- The ideal gas law is given by $$P = \frac{nRT}{V}$$

- The van der Waals equation corrects for high pressure effects and is given by

$$P = \frac{nRT}{V - nb} - \frac{n^2 a}{V^2}$$

- Plot pressure vs. volume for n=1, T=300 K. R=0.08206 L-atm/mol-K, a=1.39 L2-atm/mol2, and b=0.0391 L/mol. Use 0.08<V<6 liters