

# Orbit

**Here you will try an orbital simulation. This is your chance to pilot a space ship and maybe even get it into orbit. Take your own sheet of paper to the computer, and make sure that everyone in the group gets a chance to fly the spaceship.**

## Part 0 - DOS Box

1. Run DOS Box by double clicking on its icon on the desktop. Type these commands at the prompt:

```
mount c c:\orbit  
c:  
cycles=max
```

These will make the simulated c: a folder in our root called /orbit, then change our working drive to c:. The last command tells the DOS environment to run as fast as possible.

## Part 1 - Orbit (Write down your own answers to the bold questions)

1. Type orbit2 at the prompt. You will see a list of instructions which you should read, and maybe even take a few notes on. (The control keys will be displayed as you play the game, so don't worry) Strike any key to continue. When the program asks you for a time increment type 50. The larger the increment, the faster the simulation runs, the smaller the increment, the more accurate it is.

2. Play the game. Practice until you can make your ship orbit in a near circular path, a goodly distance from the star. (If you venture too close the computer simulation breaks down due to errors in calculation. This is evidenced by the failure of your ship to follow the same path more than once around the star even when you make no control commands. In real life you would follow the same path over and over and over.)

3. Start over, and quickly type the "o" key to put yourself into a perfect circular orbit. Let the spaceship complete one revolution and then slow the ship down abruptly by hitting the "r" key 5 times quickly.

•**Do you eventually speed up or slow down?**

•What is the relationship between the new orbit and the old? **Draw a picture of the new orbit in relationship to the old.** (There is a unique relationship - called Duggan's Theorem by the great TD himself) Can you get back to the old orbit by hitting the "s" key 5 times?

4. Compare the orbital speeds of a close orbit to a far orbit.

•**Which orbit is faster?**

5. Get into an elliptical orbit and observe your motion.

•**Draw a picture of your orbit, and label the regions where you are going the fastest and the slowest.**

•Conservation of energy would imply that the total energy of a satellite would remain constant. Kinetic energy is the energy of motion, and if you are moving faster, you have more kinetic energy. Gravitational potential energy in the case of a satellite is the greatest when it is farthest from the planet. The sum of these should remain constant. •**Draw a diagram of an elliptical orbit, and •show where the object has more potential energy, and where it has more kinetic.**

•**Is this consistent with conservation of energy?** (That the total remains constant)

Write your own personal (unlike any other person's) answer to all 5 bulleted (•) questions from steps 3-5 on a sheet of your own paper.

## Part 2 – New Orbit (nothing to write down)

1. Type neworbit at the prompt and follow the directions. (The time increment is the same as orbit) Use the concept of tangent orbits to get your spaceship into both the upper and lower orbits. To program your fire, type p, a number, and then r to slow down, or s to speed up. See if you can figure out the perfect program to go into one of the suggested orbits.

2. Isn't that neat.

## Part 3 – Apollo mission (nothing to write down)

1. Type apollo2 at the prompt. You will initially be in orbit around the earth, and the moon will be in the lower right corner of the screen. Make sure that the caps lock key is off. **When the program asks you for a time increment use .5**

2. Use the "s" key at the proper time to boost your ship out of orbit, and toward the moon.

3. Use the arrow keys on the number pad to make mid course corrections to your path. You want to come in toward the moon a little to the side.

4. See what happens if you let it coast.

5. Type z to start over, and repeat steps 2 and 3, but this time hit the retro rockets right when you are next to the moon. Hit it too many times and you will crash into the moon, too few, and you will be lost in space.

6. Do this until you can get into orbit around the moon. Then do the same procedure to get back to earth orbit. Practice your skills!

7. Isn't that neat!