

HOMEWORK 1: due Wednesday 13 September 2006 in class (or turn them in before then to my mailbox, 5th floor, Sterling Hall). Show your working (for partial credit if you make an arithmetic error), and attach an extra sheet of paper if you need it.

1) This is an exercise on powers-of-ten: see Appendix A of the text if you need a review. Light travels at 300,000 km/sec; the Sun is 150 million km away. Write both these numbers in powers-of-ten form: _____

How many seconds does the Sun's light take to reach Earth?

How many minutes is this?

How long does the Sun's light take to reach Jupiter (see Table B2)?

One light-year is the distance that light travels in a year. From the information in this question, find how many kilometers there are in a light-year. Write your answer in powers-of-ten form.

The nearest star is 4.3 light years away. How many times further away is it than the Sun? Explain how you found your answer – there are at least 2 ways to calculate this.

2) Powers-of-ten are useful outside of science as well. Write in powers-of-ten form

US GDP (money earned) 2005	\$12.5 trillion	\$ _____
Federal budget for 2005	\$2.5 trillion	\$ _____
Federal budget deficit in 2005	\$320 billion	\$ _____
US public debt 2005	\$8.5 trillion	\$ _____
US population 2005	297 million	_____

a) What fraction is the Federal budget of the total money earned by businesses and people in the US in 2005?

(Social Security and some other programs are 'off-budget', so they not included here.)

c) What fraction of the Federal budget is the deficit (difference between government spending and money coming in) for 2005?

d) What is the GDP per person in the population? How many dollars of public debt per person?

3) More Federal budget numbers from 2005; first 3 are the largest items. Write as powers-of-ten:

Health and Human Services	\$580 billion	\$ _____
Military budget (this does not include special appropriations for Iraq and Afghanistan)	\$0.5 trillion	\$ _____
Interest on public debt	\$361 billion	\$ _____
Foreign aid	\$15 billion	\$ _____
NASA	\$15,600 million	\$ _____

a) What fraction of the budget went for interest on the debt?

b) What fraction was spent on aid to poor countries? What fraction went to NASA?

4) In Figure 1.5 of the text, how long does it take each star to go all the way around the north celestial pole? Explain.

Pick a bright star and measure the length L of the bright trail that it makes, and the distance R from the celestial pole (the center of all the arcs, near the pole star).

What fraction is L of the whole circle $2\pi R$?

How long was the time exposure in the figure?

5) The Moon travels around the Earth in a nearly circular orbit at a distance of 380,000 km; write this in powers-of-ten notation.

The Moon takes 27 days to go around once: how many seconds is this (use powers-of-ten)?

How fast is the Moon moving, in kilometers per second?

Use the same method to find how fast the Earth goes around the Sun.

Does Earth move faster than the Moon does in its orbit or slower?

6) Use the internet and your text to find out if the constellation of Orion (the hunter) can be seen during hunting season.