

Section 3B: Homework Solutions

August 31, 2005

Do the following make sense:

9. I read a book that had 10^5 words in it.

Solution:

This statement makes sense. Most longer books have at least 100,000 words.

□

10. I have seen about 10^{50} commercials on television.

Solution:

This statement does not make sense. There have been nowhere near 10^{50} commercials broadcast since the invention of television.

□

18. Write each of the following in scientific notation:

a) $64,598 \rightarrow 6.4598 \cdot 10^4$

b) $0.92 \rightarrow 9.2 \cdot 10^{-1}$

c) $500.098 \rightarrow 5.00098 \cdot 10^2$

d) $0.002 \cdot 10^6 \rightarrow (2 \cdot 10^{-3}) \cdot (10^6) = 2 \cdot 10^3$

e) 250 million $\rightarrow 250 \cdot 10^6 = 2.5 \cdot 10^8$

f) $-23,800 \rightarrow -2.38 \cdot 10^4$

□

19. Do the following operations without a calculator. Express your solution in scientific notation.

a) $(3 \cdot 10^4) \cdot (8 \cdot 10^5) = 24 \cdot 10^9 = 2.4 \cdot 10^{10}$

b) $(6.3 \cdot 10^2) + (1.5 \cdot 10^1) = 630 + 15 = 645 = 6.45 \cdot 10^2$

c) $(9 \cdot 10^3) \cdot (5 \cdot 10^{-7}) = 45 \cdot 10^{-4} = 4.5 \cdot 10^{-3}$

d) $(4.4 \cdot 10^{99}) / (2.0 \cdot 10^{11}) = 2.2 \cdot 10^{88}$

□

21.

- a) 10^{35}
- b) 10^{27}
- c) 1 billion
- d) $3.5 \cdot 10^{-2}$
- e) 1 thousand
- f) 10^{12}

□

57. Calculate the scaled distance data for all the planets using a 1 to 10 billion scale model solar system. Give your results in table form.

Solution:

Planet	Model Distance
Mercury	6 m
Venus	11 m
Earth	15 m
Mars	23 m
Jupiter	78 m
Saturn	143 m
Uranus	287 m
Neptune	450 m
Pluto	590 m

□

58. Interstellar Travel. The fastest spaceships launched to date are travelling away from Earth at speeds of about 50000 kilometers per hour. How long would such a spaceship take to reach the nearest star 4.3 light-years away?

Solution:

Since a light year is $9.5 \cdot 10^{12}$ kilometers from Earth, the nearest star is $4.3 \cdot 9.5 \cdot 10^{12} \approx 40.9 \cdot 10^{12}$ kilometers away. Dividing the distance by the velocity, we find it would take the spaceship

$$\frac{40.9 \cdot 10^{12} \text{ km}}{5 \cdot 10^5 \text{ kph}} \approx 8.2 \cdot 10^7 \text{ hours}$$

Converting to years we find

$$8.2 \cdot 10^7 \text{ h} \cdot \frac{1 \text{ day}}{24 \text{ h}} \cdot \frac{1 \text{ year}}{365 \text{ days}} \approx 9360 \text{ years}$$

59. Universal Timeline. According to modern astronomy, the universe is about 14 billion years old. Suppose you represent this age with a timeline 100 meters long. What distance along the timeline represents 1 billion years? Written human history extends back about 10,000 years. How far would that be on the timeline?

Solution:

One billion years would be $\frac{100}{14} = 7.14$ meters on the timeline. 10,000 years would be represented

$$10^5 \cdot \frac{100}{14 \cdot 10^9} \approx 7.1 \cdot 10^{-5} \text{ meters}$$

which is 0.071 of one millimeters.

□