# Principles of Percent

<table>
<tr>
<td colspan="2">1. If N is <em>increased</em> by r % of itself,<br>the result is (100 + r)% of N.<br><br>→</td>
<td colspan="2">Example:<br><br>An item costs $200 with 6% tax added on.<br><br>Note the two methods below.</td>
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<td colspan="2"><strong>Usual method</strong><br><br>Figure the tax: 200 (0.06) = 12<br><br>Figure the total: 200 + 12 = 212</td>
<td colspan="2"><strong>Cool way</strong><br><br><em>Think</em>:<br><br>"100% + 6% = 106% = 1.06"<br><br><em>Calculate</em>: <strong>200(1.06) = 212</strong></td>
</tr>
<tr>
<td colspan="4" align="center">Similar problems</td>
</tr>
<tr>
<td>An investment of $200 at 6% simple interest will grow in one year to $212.</td>
<td colspan="2">A town of population 200 which will increase in size by 6% will contain 212 people.</td>
<td>A person making $200 per week is about to get a 6% raise, after which the person will be making $212 per week</td>
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<tr>
<td colspan="2">2. If N is <em>decreased</em> by r % of itself,<br>the result is (100 − r)% of N.<br><br>→</td>
<td colspan="2">Example:<br><br>An item costs $200 is on sale for 6% off.<br><br>Note the two methods below.</td>
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<tr>
<td colspan="2"><strong>Usual method</strong><br><br>Discount: 200(0.06) = 12<br><br>Sale price: 200 − 12 = 188</td>
<td colspan="2"><strong>Cool way</strong><br><em>Think</em>:<br><br>"100% − 6% = 94% = 0.94"<br><br><em>Calculate</em>: <strong>200(0.94) = 188</strong></td>
</tr>
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<td>An early withdrawal of $200 carries a 6% penalty, which leaves the owner with $188.</td>
<td colspan="2">A town of population 200 which will decrease in size by 6% will shrink to 188 people.</td>
<td>A person making $200 per week is about to get a 6% reduction in pay, after which the person will be making $188 per week.</td>
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</table>

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|---|---|
| 3. If a number is *split* into two or more parts, the parts total 100% of the number. $\longrightarrow$ | If an item is discounted $r$%, then $(100 - r)$% is *not* discounted. |

| Example |
|---|
| What will be an automobile's selling price if its sticker price of $20,000 will be discounted 10%? |

| **Usual method** | **Cool way** |
|---|---|
| 20,000(0.1) = 2,000 <br><br> 20,000 – 2,000 = 18,000 | *Think*: <br><br> "100% –10% = 90% = 0.9." <br><br> *Calculate*: : **20000(0.9) = 18,000** |

| Similar problems |
|---|

| | |
|---|---|
| If the seller of a house must pay the real estate agent a commission of 8%, what remains as the seller's share must be the other 92%. $\longrightarrow$ | If the seller of a house hopes to receive $72,000 after paying the agent 8% of the selling price, it is not possible to calculate the selling price by taking 8% of 72,000 and adding the result to 72,000. Reason? The agent will get 8% of the *selling price* not 8% of the seller's share. One must realize that the seller's share represents 92% of the unknown selling price. Using algebra, if the selling price is $x$, then: <br><br> $$x - 0.08x = 72,000$$ <br><br> $$0.92x = 72,000$$ <br><br> $$x = 72,000/0.92 = 78,260.87 \text{ (rounded to}$$ the nearest penny) |

Suppose that 40% of the people surveyed were democrats, 35% were republicans, and the remaining 150 were independents. How many people surveyed were democrats and how many were republicans? First, note that, since 40% + 35% = 75%, then "the rest" must be 100% - 75% = 25%.

Let $x$ represent the total number surveyed. Then 25% of them were independents. Thus,

$0.25x = 150$
$x = 150/0.25 = 600$

Then there were 0.4(600) = 240 democrats and 0.35(600) = 210 republicans.

| | |
|---|---|
| 4. Often, an item is *discounted* and then tax is *added*. The usual way to calculate is to figure the amount of the discount, subtract that from the original, then multiply by the tax rate and add the tax on. $\longrightarrow$ | Example. A sweater marked at $50 will be discounted 20%. The tax rate is 7.5%.<br><br>Note the two methods below. |

| Usual method | Cool way |
|---|---|
| Discount: $50(0.2) = 10$<br><br>Sale price: $50 - 10 = 40$<br><br>Tax: $40(0.075) = 3$<br><br>Total cost: $40 + 3 = 43$ | $50(0.8) = 40$ (Where did the 0.8 come from?)<br><br>$40(1.075) = 43$ (Where did the 1.075 come from?) |

Okay, try this one, using the cool way. A car dealer agreed to discount the $25,000 sticker price of a new van by 20%. Added to the cost are 7.5% sales tax and $350 in nontaxable fees. What is the total cost?

| | |
|---|---|
| 5. Sometimes, data are given in categories and we are to determine what percent each category represents. $\longrightarrow$ | Example. A class consists of 12 women and 8 men. What percent are women?<br><br>The key is to realize that there are 20 people, 12 of whom are women. So we must change 12/20 to a percent:<br>$12 \div 20 = 0.6 = 60\%$ |

| Similar problems ||
|---|---|
| The Yankees have won 12 and lost 8 of their games so far this season. What percent of their games have they won? | Katie has lost 12 of her baby teeth and has 8 more to go. What percent of her baby teeth has she lost? |

| Extension ||
|---|---|
| A college has 12 women *for every* 8 men. What percent are women? (Note that it is not necessary to know the total population of the college.) | For the experts. In Bexar County, there are 89.7 men for every 100 women. What percent are women? Round to the nearest 0.1%. |

$\mathcal{B}$ $3.1$

Understanding these two fundamental principles of percent will empower one to work everyday problems whose solutions elude most people.

1.  If you buy an item to which 6% tax is added, you pay 106% of the price. Hence, if the price of the item is $50, you pay 50(1.06) = $53.

2.  If an item is discounted 6%, you pay 94% of the price. Hence, if the price of the item before discount is $50, you pay 50(0.94) = $47.

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Illustration. A pair of snow boots regularly sells for $200, but is on sale for 20% off. A sales tax of 6.5% will be added to the sale price.

Note the two methods below.

| Usual method (which most people know) | Cool way (which most people do not know) |
|---|---|
| Figure the discount: 200 (0.2) = 40<br><br>Figure the sale price: 200 – 40 = 160<br>same answer → | Rather than figure the 20% off, let's determine the 80% that *remains*:<br><br>**200(0.8) = 160** |
| Figure the tax on $160 and add it to $160:<br><br>160(0.065) = 10.40<br>160 + 10.40 = 170.40 same answer → | 100% + 6.5% = 106.5% = 1.065<br><br><br>**160(1.065) = 170.40** |

Barry wants to buy a new Ford Mustang. The dealer has agreed to discount the sticker price of $25,500 by 10%. A sales tax of 6.5% will be added to the discounted price. Nontaxable fees of $229.25 will be added. What is the total "out-the-door" amount?

| Usual way | Cool way |
|---|---|
| Discount is 10% of 25,500:<br><br>25500(0.1) = 2550.<br><br>25500 − 2550 = **22,950**     same answer → | 10% off leaves 90%:<br><br><br>25500(0.9) = **22,950** |
| Figure tax and add to selling price:<br><br>22950(0.065) = 1491.75<br><br>22950 + 1491.75 = **24,441.75**<br>                              same answer → | Tax + selling price is 106.5% of selling price:<br><br><br><br>22950(1.065) = **24,441.75** |
| Add the fees:<br><br>24,441.75 + 229.25 = **24,671** | Add the fees:<br><br>24,441.75 + 229.25 = **24,671** |

Okay, the cool way is faster, but its real value is that it allows one to solve the companion problem, which asks for the original sticker price given the out-the-door price, fees, sales tax rate, and discount rate. Illustration.

**Barry Broke paid a total of $24,671 for his used VW bus. This figure includes $229.25 in fees and 6.5% sales tax on the actual cost of the truck, which was 10% less than the sticker price. What was the sticker price?**

Step 1. Subtract the fees from the total price. 24,671 − 229.25 = 24,441.75.

Note that the tax is included in the $24,441.75, but multiplying that number by 0.065 will *not* calculate the tax. **Instead, one must realize that 24,441.75 is 106.5% of the price.** To determine the price, one must solve "1.065 times what number = 24,441.75?" This leads to step 2.

Step 2. Figure the price before tax by dividing 24,441.75 by 1.065, obtaining 22,950.

Note that 22,950 reflects a 10% discount on the sticker price, but the discount is *not* 10% of 22,950. **Instead, one must realize that 22,950 is 90% of the sticker price.** To determine the sticker price, one must solve "0.9 times what number = 22,950?" This leads to step 3.

Step 3. Figure the sticker price by dividing 22,950 by 0.9, which is 25,500, the original sticker price.

The faculty salary schedule at a certain community college has 29 pay levels.

Question: The faculty salary schedule at a certain community college has 29 pay levels. In class VII, the first is $45,312 and the last is $82,969, but the percent increase from one level to the next varies. What constant percent raise, if given to every level after the first, would result in the 29th and final level remaining $82,969? Alternatively, what constant percent raise would result in the 26th level remaining at $78,324?

In the salary schedule excerpt here, only a few entries are included for demonstration purposes.

| Level ↓ | Class | | | | | | |
|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII |
| A | $35,049 | $38,758 | $39,841 | $40,943 | $42,044 | $43,128 | $45,312 |
| B | | | | | | | $47,112 |
| C | | | | | | | $48,140 |
| . | | | | | | | . |
| . | | | | | | | . |
| . | | | | | | | . |
| Z | | | | | | | $78,324 |
| AA | | | | | | | $79,646 |
| AB | | | | | | | $80,968 |
| AC | $60,790 | $68,299 | $70,613 | $72,963 | $77,057 | $77,626 | $82,969 |

Note that the entries after level A do not reflect a certain percent increase that remains constant throughout the schedule. Here is an example using figures from class VII.

| LEVEL | Salary | Percent raise over previous level |
|---|---|---|
| A | $45,312 | |
| B | $47,112 | 3.97% |
| C | $48,140 | 2.18% |
| . | . | . |
| . | . | . |
| . | . | . |
| Z | $78,324 | |
| AA | $79,646 | 1.0168786% |
| AB | $80,968 | 1.016598% |

| | | |
|---|---|---|
| AC | $82,969 | 1.024713% |

Here's the math.

Let, A, B, C, etc. represent the actual dollar amounts for the corresponding levels. To illustrate, in order to make B, for example, 5% more than A, one could simply add A to 0.05 times A. It is equivalent to determine B by multiplying A by 1.05. Then C would be B times 1.05, which is the same thing as $A(1.05)^2$. Each level would be 1.05 times the one just above it, so that the 29th level would be $A(1.05)^{28}$.

For A = $45,312, a 5% raise would make level AC $177,628.90, which is slightly more than the actual value of $82,969.

So what value of $x$ would make $45312(1 + x)^{28}$ equal to 82969?

Among the choices are:

- Simply experiment with various values of $x$ until the desired value is determined.

- Solve the equation $45312(1 + x)^{28} = 82969$.

Let's do the second choice.

| | |
|---|---|
| $45312(1 + x)^{28} = 82969$ | |
| $(1 + x)^{28} = \dfrac{82969}{45312}$ | |
| $(1 + x)^{28} \approx 1.83106$ | |
| $1 + x = \sqrt[28]{1.83106}$ | One way to use a calculator to evaluate $\sqrt[28]{1.83106}$ is to use the fact that $\sqrt[n]{z} = z^{\frac{1}{n}}$ |
| $1 + x \approx 1.0218384369$ <br><br> Hence, <br><br> $x \approx 0.0218384369$ | Here are the keystrokes: <br><br> $1.83106 \wedge (1 \div 28) =$ <br><br> where the "$\wedge$" means "raised to the power of." On some calculators, the key looks like one of these: $x^y, y^x, \text{or } x{\wedge}y$ |

| Check:<br><br>$45312(1.0218384369)^{28} = 82968.99$<br><br>which is a penny off due to the rounding off of the value of $x$. | |

If, instead of setting the first and last levels, one wished to work with levels beyond Z in some other way, and instead set level A at 45312 and level Z at 78324, then there would be 25 raises after level A so that one could solve:

$45312(1 + x)^{25} = 78324$, obtaining

$x = \sqrt[25]{\frac{78324}{45312}} - 1 \approx 0.022132659173959883737$, which implies a raise of about 2.21% per level for the first 25 levels after the first.

Check: $45312(1.02213265917395988)^{25} = \$78,324$, which is indeed level Z.

It would be a simple matter to create an Excel spreadsheet to make the calculations based on inputting any desired pair of salaries, such as level A and any other level.

**Monday,** January 19, 1998

## State lawmaker off on his numbers

Re: Jan. 14 news report, "Critics say statistics prove weapons law is threat to public":

Being a nitpicker, please allow me to point out that if your reporting was correct, at least one Texas lawmaker needs to go back to elementary school to learn some basic arithmetic.

Texas Sen. Jerry Patterson, R-Pasadena, was quoted as saying that 946 license holders is "a miniscule .006 percent of the 163,-665 who hold a CHL (Concealed Handgun License)."

He needs to multiply that number by 100. My fourth-grade teacher taught me that 1 percent is .01 of whatever.

Patterson should have used the value 0.6 percent, or about one in every 160 persons.

That's not miniscule by the way.

**Jan Van Den Hende**

**Thursday,** January 22, 1998

## Nitpickers should check carefully before picking

Re: Jan. 19 letter, "State lawmaker off on his numbers":

Letter writer Jan Van Den Hende must be a product of new math. State Sen. Jerry Patterson's figures are correct, based on the information given.

To obtain the percentage of 946 licensed holders out of 163,665 concealed handgun Licenses, one merely has to divide 946 by 163,665. The result is 0.0057801 which, rounded off, equals 0.006 percent. To prove the answer, simply multiply 163,665 by 0.0057801 and the answer comes back to 946.

Jan's fourth-grade teacher is correct in teaching that 1 percent is 0.01. What Jan failed to learn is the decimal/percent equivalents. The first position after the decimal is tenths and the second position is hundredths. Therefore, 0.01 is one one-hundreth, or 1 percent.

Who needs to go back to elementary school? Certainly not the lawmaker referred to.

Nitpickers, as Jan professed to be, should verify their facts before exposing their lack of knowledge.

**James Davis**

PLEASE WRITE ANSWERS IN THE LEFT MARGIN

Name_____

1. William Robert bought a new Mahindra Tractor for $45,000. He must also pay sales tax of 7.875%. One way of calculating the total price, including the tax is:

   45000 + 45000(0.07875). What is another way, involving a single multiplication?

   Write the calculation; put result in left margin_____

2. Eddie Rapido bought a pool table for $5805, including 7.5% sales tax. Let $x$ represent the price of the table before tax. Write an equation involving $x$ and 5,805. Solve the equation.
   Equation:_____

3. In 1989, Jimmy the Geek bought a new Apple IIe computer for $1,995. In 2003, he purchased a Power Mac computer for $2995. What percent of 1995 is 2995?

4. Nita Loan will deposit enough money at 6% simple interest to have $2,000 in savings at the end of one year. Let $x$ represent the amount she will deposit. Write an equation involving $x$ and 2,000. Solve the equation. Round $x$ to the nearest dollar.

   Equation:_____

5. Ima Hunter wants to make sausage consisting of 50% pork, 45% beef, and the rest venison. How much beef will she need if she will use 150 pounds of venison?

6. Kripsy Krud sells doughnuts for $9.50 a dozen, tax included. The tax rate is 7.875%. Let $x$ represent the cost of the doughnuts before tax. Write an equation involving $x$ and 9.50. Solve the equation. To the nearest penny, how much of the $9.50 is tax and how much is to pay for the actual doughnuts?

   Equation:_____

7. Mr. and Mrs. Mort Gage are selling their house and want to have $166,250 left after paying a realtor 6% of the selling price? To solve this problem, let $x$ be the selling price of the house. Write an equation involving $x$ and 166,250. Solve the equation.

   Equation:_____

8. Car salesman Slick Willy agreed to discount the $27,000 sticker price of a new van by 8%. Added to the cost are 6% sales tax (on the discounted price) and $265 in fees. (There is no tax on the fees.) What is the total "drive out" cost?  One way to work this problem is:

  (a)  27000 - 0.08(27000) = 24,840  (b) 24,840 + 0.06(24,840) = 26,330.40
  (c)  26,330.40 + 265 = 26,595.40

    (A)  What other calculation would give the answer to part (a)?

    Calculation:_____

    (B)  What other calculation would give the answer to part (b)?

    Calculation:_____

9. Barry Broke paid a total of $13,000 for his used VW bus.  This figure includes $850 in fees and 8% sales tax on the actual cost of the truck, which was 10% less than the sticker price. What was the sticker price?

10. Cookie Baker needs a new oven.  She wants to withdraw enough money from her IRA so that she has $9,000 cash after paying the IRS 30% of the amount withdrawn.  Let $x$ stand for the amount withdrawn.  Write an equation involving $x$ and 9000.  Solve the equation.  Round the answer to the nearest dollar.

11. As some time during the season, the Dullas Cowboys' record was 5 wins and 2 losses.  What was their winning percentage at that time?

12. The grade distribution for a college algebra class is given below.  Fill in the third column.

| Grade | Number receiving this grade | Percent of students who received this grade |
|-------|-----------------------------|---------------------------------------------|
|       |                             |                                             |
| A     | 5                           |                                             |
| B     | 7                           |                                             |
| C     | 10                          |                                             |
| D     | 2                           |                                             |
| F     | 1                           |                                             |

Name_____Percent Test                    406081200

If arithmetic fails, consider using algebra!

1.  _____The sticker price for a car is $10,000.  The buyer must also pay tax, title, and license fees.  The tax is 8.25% of the sticker price; the title fee is $20 and the license fee is $60.  What is the total "out the door" price?

2.  _____C. Cruz bought a motorboat for $1437.75 including 6.5% sales tax.  What was the cost of the boat before the tax?

3.  _____The national debt last year was 4.5 trillion dollars.  This year it is 6 trillion dollars.  To the nearest 0.1%, what is the percent increase from last year to this year?

4.  _____Mucho DeNerro wants to deposit enough money at 8% simple interest to have $1000 in savings at the end of one year.  To the nearest dollar, how much does he need to deposit?

5.  _____Following are the results of a survey:

A.  33% of those surveyed said they like only beef.

B.  25% of those surveyed said they like only pork.

C.  29% of those surveyed said they like both.

D.  The other 26 people said they like neither.

How many people were surveyed?

6.  _____Ima Hunter wants to make sausage consisting of 50% pork, 27% beef, and the rest venison.  What is the total amount of meat (pork, beef, and venison together) she needs if she will use 184 pounds of venison?

7.  _____What should the selling price of a house be if the seller wants to have $63,000 left after paying a realtor 10% of the selling price?

8.  _____A car dealer agreed to discount the $20,000 sticker price of a new van by 15%.  Added to the cost are 6% sales tax and $115 in fees.  (There is no tax on the fees.)  What is the total cost?

ANSWERS ON pages B12-B16

6

Name_____Percent Test                    406081200

9.  _____John paid a total of $14,057.20 for his new truck.  This includes $150 in fees and 6% sales tax on the actual cost of the truck, which was 20% less than the sticker price.  What was the sticker price?

10.  _____Cher Kropper wants to put 100 pounds of potassium per acre in a 90-acre field.  How many 50-pound bags of fertilizer should she buy if each bag contains 40% potassium?

11.  _____Irma needs $2000 for a down payment on a new truck.  She wants to get the money from her IRA.  Unfortunately, she must pay the IRS 30% of the amount withdrawn.  To the nearest dollar, how much should she withdraw in order to have $2000 cash left after paying the IRS 30% of the amount withdrawn?

12.  _____Abel Carpenter is a homebuilder.  The income from the sale of a house is divided as follows:

| Salesperson | 5% |
| Insurance | 2% |
| Company salaries | 20% |
| Advertising | 3% |
| Land, labor, materials | 70% |

Rounded to the nearest hundred dollars, what should Abel charge for a house if the land cost $2000, the labor was 500 hours at $12.00 per hour, and the materials came to $36,000?

13.  _____Sally makes $1400 per month.  She would like her salary to be $1700.  To the nearest 1%, what percent raise should she ask for?

14.  Mr. G. is considering buying dental insurance.  The premiums are $60 per month for one year.  There is an annual deductible of $25 which he must pay before the insurance pays anything.  After the $25 deductible has been paid, the insurance will pay only 70% of the rest of the dental bills; Mr. G. must pay the other 30%.  He figures that he will have about $1000 in dental bills during the year that the policy is in effect.

a.  _____Should he buy the insurance?  Why or why not?

b.  _____What is the "break even" amount?  That is, how much money in dental bills must Mr.G. accumulate before it is cost-effective for him to purchase the insurance?

7

Name_____

1. The sticker price for a motorcycle is $2,000. The buyer must also pay tax, title, and license fees. The tax is 6.25% of the sticker price; the title fee is $95 and the license fee is $55. What is the total "out the door" price?

2. Mo DeLaun bought a lawn mower for $1623.75 including 8.25% sales tax. What was the cost of the mower before the tax?

3. In 1991, the sticker price of a new Ford Ranger was $8,000. The 1995 model sold for $8,520. What was the percent increase in cost from 1991 to 1995?

4. Beau Coo Bucks wants to deposit enough money at 5% simple interest to have $3,000 in savings at the end of one year. To the nearest dollar, how much does he need to deposit?

5. Ura Hunter wants to make sausage consisting of 50% pork, 37% beef, and the rest venison. How much pork will she need if she will use 65 pounds of venison?

6. The Barbecue Station sells sandwiches for $6.00. This price includes $7\frac{3}{4}$% sales tax. How much of the $6.00 represents the cost of the sandwich and how much is tax?

7. What should the selling price of a house be if the seller wants to have $81,780 left after paying a realtor 6% of the selling price?

8. A car dealer agreed to discount the $18,000 sticker price of a new van by 20%. Added to the cost are 6.25% sales tax (on the *discounted* price) and $85 in fees. (There is no tax on the fees.) What is the total "drive out" cost?

9. John paid a total of $15,432 for his new truck. This figure includes $115 in fees and 6% sales tax on the actual cost of the truck, which was 15% less than the sticker price. What was the sticker price?

10. Rob deBank wants to withdraw enough money from his IRA so that he has $4800 cash to spend after paying the IRS 33% of the amount withdrawn. To the nearest dollar, how much should he withdraw?

7A

PLEASE WRITE YOUR ANSWERS IN THE LEFT MARGIN

Name_____

1. Jimmy de Locke bought a new set of tools for $2,200. He must also pay sales tax of 7.8%. What is his total cost, including sales tax?

2. Susie Cue bought a pool hall for $63,962.50. This price includes 7.5% federal tax. What was the price of the pool hall before tax?

3. In 1999, Amir bought a new television set for $690. In 2003, he purchased a similar model for $490. What was the percent decrease from 1999 to 2003? Round to the nearest 0.1%.

4. Cher Kropper needs to put aside enough money at 7% simple interest so that it will grow to $5,000 in one year. What amount will accomplish this goal? Round to the nearest dollar.

5. Spike Buck wants to make sausage consisting of 40% pork, 35% beef, and the rest venison. How much beef will she need if she will use 300 pounds of venison?

6. Kripsy Krud sells doughnuts for $9.85 a dozen, tax included. The tax rate is 7.75%. How much of the $9.85 goes for tax?

7. Dr. Stella Lemon is selling her BMW 740 on consignment by leaving it with a dealer, who will get 20% of the selling price. What must the selling price be in order for Dr. Lemon's share to be $58,000?

8. Barry Broke paid a total of $16,200 for his used VW bus. This figure includes $297 in fees and 8% sales tax on the actual cost of the truck, which was 5% less than the sticker price. What was the sticker price?

9. Georgia Peach needs a new kitchen. She wants to withdraw enough money from her IRA so that she has $48,000 cash after paying the IRS 27% of the amount withdrawn. To the nearest dollar, how much does she need to withdraw?

10. If the Spurs finish the season with a record of 47 wins and 35 losses, what percent of their games will they have won? Write answer to the nearest 0.1%.

β 11

Name_____

11. The College is eligible to receive a government grant of $2.5 million to start an engineering program. The grant requires that the College's contribution to the new program be 2% of the total budget for the program, with the remainder being the $2.5 million dollars provided by the government. How much money is the College required to provide?

12. Suppose that the Minnesota Meteorologists have won 100 games and lost 60 over the last 10 years. What is their winning percentage for the 10-year period? Express your answer in two ways: (a) as a decimal rounded to the nearest 0.001 and (b) as a percent rounded to the nearest 0.1%.

13. If there are 100 male students for every 60 female students at Northwest Vista College, what percent of the students are females?

14. Mark Hammer builds houses. The selling price of a house is divided as follows: salesperson, 5%; insurance, 2%; salaries, 20%; advertising, 3%; the rest is used to pay for the lot, the labor, and the materials. What should Mark charge for a house if the lot cost $12,000, the labor was 500 hours at $15.00 per hour, and the materials came to $45,000? Round your answer to the nearest $100.

15. The grades earned in a college algebra class are given below. Fill in the five percents in the third row.

| Grade | A | B | C | D | F |
|---|---|---|---|---|---|
| Number receiving this grade | 4 | 6 | 10 | 3 | 2 |
| Percent of students who received this grade | | | | | |

16. If 25.1 students fail college algebra for every 100 who pass, what percent of them pass? Write your answer to the nearest 0.1%.

Name_____Percent Answers            · 406081200

If arithmetic fails, consider using algebra!

1.    The sticker price for a car is $10,000.  The buyer must also pay tax, title, and license fees. The tax is 8.25% of the sticker price; the title fee is $20 and the license fee is $60.  What is the total "out the door" price?

Solution:  $10,000 + 0.0825(10,000) + 20 + 60 = \textbf{\$10,905}$
or:  $10,000(1.0825) + 20 + 60 = \$10,905$

2.    C. Cruz bought a motorboat for $1437.75 including 6.5% sales tax.  What was the cost of the boat before the tax?

Solution:  Let $x$ = the price of the boat before taxes.

Then:  $x + 0.065x = 1437.75$
          $1.065x = 1437.75$
              $x = 1437.75/1.065 = \textbf{\$1,350}$

3.    The national debt last year was 4.5 trillion dollars.  This year it is 6 trillion dollars.  To the nearest 0.1%, what is the percent increase from last year to this year?

Solution:  Change the following to a percent:  (new - old)/old

$(6 - 4.5)/4.5 = 0.33333333$.  To the nearest 0.1%, the answer is **33.3%**

4.    Mucho DeNerro wants to deposit enough money at 8% simple interest to have $1000 in savings at the end of one year.  To the nearest dollar, how much does he need to deposit?

· Solution:  Let x be the amount deposited.
Then:
          $x + 0.08x = 1000$
          $1.08x = 1000$
          $x = 1000/1.08 = \textbf{\$926}$ (to the nearest dollar)

5.    Following are the results of a survey:

A.  33% of those surveyed said they like only beef.

B.  25% of those surveyed said they like only pork.

C.  29% of those surveyed said they like both.

D.  The other 26 people said they like neither.

How many people were surveyed?

Solution to number five: 33% + 25% + 29% = 87%

Thus, the "other 26" people must be 100% - 87% = 13% of the total.

If x = the total number surveyed, then

$0.13x = 26$
$x = 26/0.13 = \textbf{200}$

6.    Ima Hunter wants to make sausage consisting of 50% pork, 27% beef, and the rest venison. What is the total amount of meat (pork, beef, and venison together) she needs if she will use 184 pounds of venison?

Solution: 50% + 27% = 77%. Thus, the venison must be 100% - 77% = 23% of the total. That is, if x is the total amount of meat,

$0.23x = 184$
$x = 184/0.23 = \textbf{800}$

7.    What should the selling price of a house be if the seller wants to have $63,000 left after paying a realtor 10% of the selling price?

Solution: Let x be the selling price. Then,

$x - 0.10x = 63,000$
$0.90x = 63,000$
$x = 63,000/0.90 = \textbf{\$70,000}$

8.    ·A car dealer agreed to discount the $20,000 sticker price of a new van by 15%. Added to the cost are 6% sales tax and $115 in fees. (There is no tax on the fees.) What is the total cost?

Solution: The discounted price is 20,000 - 0.15(20,000) = 20,000 - 3,000 = 17,000
                        or: 20,000(0.85) = 17,000
The price is then 17,000 + 17,000(0.06) + 115 = 17,000 + 1,020 + 115 = **18,135**
             or: 17,000(1.06) + 115 = 18,020 + 115 = **$18,135**

9.    John paid a total of $14,057.20 for his new truck. This includes $150 in fees and 6% sales tax on the actual cost of the truck, which was 20% less than the sticker price. What was the sticker price?

Solution: Before the fees, the cost was 14,057.20 - 150 = 13,907.20
          If x = the price before the tax, then x + 0.06x = 13,907.20
                        $1.06x = 13,907.20$ ⟵
                        $x = 13,907.20/1.06 = \$13,120$

(continued on next page)

Continued:

If y = the price before the discount, then y - 0.2y = 13, 120

$$0.8y = 13,120$$
$$y = 13,120/0.8 = \textbf{\$16,400}$$

10.   Cher Kropper wants to put 100 pounds of potassium per acre in a 90-acre field. How many 50-pound bags of fertilizer should she buy if each bag contains 40% potassium?

There are several ways to work this problem. Here's one. A 90-acre field requires 90(100) = 9000 pounds of potassium. A 50-pound bag contains 50(0.4) = 20 pounds of potassium. Thus the number of bags is 9000/20 = **450.**

11.   Irma needs $2000 for a downpayment on a new truck. She wants to get the money from her IRA. Unfortunately, she must pay the IRS 30% of the amount withdrawn. To the nearest dollar, how much should she withdraw in order to have $2000 cash left after paying the IRS 30% of the amount withdrawn?     2600

Solution: If she withdraws x dollars, pays the IRS 30% of x, and is left with $2,000, then

$$x - 0.3x = 2000$$
$$0.7x = 2000$$
$$x = 2000/0.7 = \textbf{\$2,857} \text{ (to the nearest dollar).}$$

12.   Abel Carpenter is a homebuilder. The income from the sale of a house is divided as follows:

| | |
|---|---|
| Salesperson | 5% |
| Insurance | 2% |
| Company salaries | 20% |
| Advertising | 3% |
| Land, labor, materials | 70% |

Rounded to the nearest hundred dollars, what should Abel charge for a house if the land cost $2000, the labor was 500 hours at $12.00 per hour, and the materials came to $36,000?

Solution: Labor costs are 500(12) = $6,000
If the house will sell for x dollars, then 70% of x goes to land, labor, and materials:

$$0.7x = 2,000 + 6,000 + 36,000 = \$44,000$$
$$x = 44,000/0.7 = \$62,857.14 = \textbf{\$62,900} \text{ to the nearest hundred dollars.}$$

Name_____Percent Answers · 406081200

13.   Sally makes $1400 per month. She would like her salary to be $1700. To the nearest 1%, what percent raise should she ask for?

Solution: Sally wants a raise of 1700 - 1400 = $300
The raise will be based on her old (current) salary. Change 300/1400 to a percent:
300/1400 = 0.2142857 = **21%** to the nearest 1%.

14.   Mr. G. is considering buying dental insurance. The premiums are $60 per month for one year. There is an annual deductible of $25 which he must pay before the insurance pays anything. After the $25 deductible has been paid, the insurance will pay only 70% of the rest of the dental bills; Mr. G must pay the other 30%. Mr. G. figures that he will have about $1000 in dental bills during the year that the policy is in effect.

a.   Should he buy the insurance? Why or why not?

b.   What is the "break even" amount? That is, how much money in dental bills must Mr. G. accumulate before it is cost-effective for him to purchase the insurance?

Solution:

| Dollar amount of bills | Cost without insurance   - | Cost with insurance: monthly premium times 12, plus $25 deductible, plus 30% copayment |
|---|---|---|
| $1000 | $1000 | 60(12) + 25 + 0.3(1000 - 25)<br><br>= 720 + 25 + 0.3(975)<br><br>= 745 + 292.50 = **$1037.50**  (Cheaper without insurance) |
| Let x be the amount of bills such that Mr. G. pays the same whether he has insurance or not.<br><br>x | x | 60(12) + 25 + 0.3(x - 25) |

Part b asks for the break-even amount. If Mr. G. is to pay the same whether or not he buys the insurance, then the amounts in columns two and three must be equal:

x = 60(12) + 25 + 0.3(x - 25)
x = 720 + 25 + 0.3x - 0.3(25)
x = 745 + 0.3x - 7.50
x - 0.3x = 745 - 7.50
0.7x = 737.50
x = 737.50/0.7 = **$1,053.57** to the nearest penny.

8. A car dealer agreed to discount the $20,000 sticker price of a new van by 15%. Added to the cost are 6% sales tax and $115 in fees. (There is no tax on the fees.) What is the total cost?

9. John paid a total of $14,057.20 for his new truck. This includes $150 in fees and 6% sales tax on the actual cost of the truck, which was 20% less than the sticker price. What was the sticker price?

| First, follow the computations in the first three columns.<br><br>Next, work column 3 from the bottom up.<br><br>Finally, work problem #9 by filling in the appropriate numbers in the blanks in the first and last columns. | Everybody-does-it way. (It works.)<br><br>↓ | Cool way. (It works better!)<br><br>↓ | Use this column and the first column to work problem #8 backwards. Note that column 2 is of no use in this kind of problem! | Page 7, #9. Pencil in the appropriate numbers for #9 and then fill in the blanks.<br><br>↓ |
|---|---|---|---|---|
| Sticker price | $20,000 | | _____ | #9 _____ |
| Discount<br><br>#8 (15%)<br><br>#9 _____ | 20,000   20,000<br> 0.15   -3,000<br>3,000   17,000 | 15% is what you DON'T pay, so 85% is what you DO pay:<br><br>20,000<br> 0.85<br>17,000 | _____ | #9 _____ |
| Sales tax<br><br>#8  6%<br><br>#9 _____ | 17,000   17,000<br> 0.06  +1,020<br>1,020   18,020 | 17,000 + 6% of 17,000 is 106% of 17,000<br><br>17,000<br> 1.06<br>18,020 | _____ | #9 _____ |
| Fees<br><br>#8  $115<br><br>#9 _____ | 18,020<br>+ 115<br>18,135 | 18,020<br>+ 115 ←<br>↘ 18,135 | ↑<br><br>$18,135<br><br>Start here and work your way up | #9 _____ |

| # | | | |
|---|---|---|---|
| 1 | $2200 + 2200(.078)$ | $2200(1.078)$ | $2371.60 |
| 2 | $x + 0.075x = 63962.50$<br>$1.075x = 63962.50$<br>$x = 63962.50/1.075$ | | $59,500 |
| 3 | $(690 - 490)/690 = 200/690 = 0.289855 = 28.9855\%$ | | 29.0% |
| 4 | $x + 0.07x = 5000$<br>$1.07x = 5000$<br>$x = 5000/1.07 = 4672.8971$ | | $4673 |
| 5 | $100 - (40 + 35) = 25$<br>$0.25x = 300$<br>$x = 300/0.25 = 1200$ | Beef $= 0.35 (1200)$ | 420 lbs |
| 6 | $x + 0.0775x = 9.85$<br>$1.0775x = 9.85$<br>$x = 9.85/1.0775 = 9.14$ | Tax $= 9.85 - 9.14$<br>Or<br>Tax $= 9.14(0.0775)$ | $0.71 or 71¢ |
| 7 | $x - 0.2x = 58000$ | $0.8x = 58000$<br>$x = 58000/0.8$ | $72,500 |
| 8 | $16200 - 297 = 15903$<br><br>$x + 0.08x = 15903$<br>$1.08x = 15903$<br>$x = 15903/1.08 = 14725$ | $y - 0.05y = 14725$<br>$0.95y = 14725$<br>$y = 14725/0.95$ | $15,500 |
| 9 | $x - 0.27x = 48000$<br>$0.73x = 48000$<br><br>$x = 48000/0.73 = 65753.424$ | | $65,753 |
| 10 | $47/(47 + 35) = 47/82 = 0.5731707 = 57.31707\%$ | | 57.3% |

| | | | |
|---|---|---|---|
| 11 | $x - 0.02x = 2500000$<br>$0.98x = 2500000$<br>$x = 2500000/0.98$ | $x = 2551020.40$<br>College's share is<br>$x - 2500000$ | $51,020.40 |
| 12. | $100/(100 + 60) = 100/160 =$ | | a. 0.625<br>b. 62.5% |
| 13 | $60/(100 + 60) = 60/160$ | | 37.5% |
| 14 | $100 - (5 + 2 + 20 + 3) = 70$<br>$500(15) + 12000 + 45000 = 64500$<br>$0.70x = 64500$<br>$x = 64500/0.70 = 92142.857$ | | $92,100 |
| 15 | $4 + 6 + 10 + 3 + 2 = 25$<br>$4/25 = 0.16$<br>$6/25 = 0.24$<br>$10/25 = 0.4$<br>$3/25 = 0.12$<br>$2/25 = 0.08$ | | 16%<br>24%<br>40%<br>12%<br>8% |
| 16 | $100/(100 + 25.1) = 100/125.1 = 0.7993605 =$<br><u>79.93605%</u> | | 79.9% |

B19

Name_____

1. Jimmy de Locke bought a new set of tools for $2,400. He must also pay sales tax of 7.8%. What is his total cost, including sales tax?

2. Susie Cue bought a pool hall for $60,737.50. This price includes 7.5% federal tax. What was the price of the pool hall before tax?

3. In 1999, Amir bought a new television set for $630. In 2003, he purchased a similar model for $430. What was the percent decrease from 1999 to 2003? Round to the nearest 0.1%.

4. Cher Kropper needs to put aside enough money at 6% simple interest so that it will grow to $7,000 in one year. What amount will accomplish this goal? Round to the nearest dollar.

5. Spike Buck wants to make sausage consisting of 40% pork, 35% beef, and the rest venison. How much beef will she need if she will use 225 pounds of venison?

6. Kripsy Krud sells doughnuts for $9.45 a dozen, tax included. The tax rate is 7.75%. How much of the $9.45 goes for tax?

7. Dr. Stella Lemon is selling her BMW 740 on consignment by leaving it with a dealer, who will get 20% of the selling price. What must the selling price be in order for Dr. Lemon's share to be $54,000?

8. Barry Broke paid a total of $12,700 for his used VW bus. This figure includes $388 in fees and 8% sales tax on the actual cost of the truck, which was 5% less than the sticker price. What was the sticker price?

9. Georgia Peach needs a new kitchen. She wants to withdraw enough money from her IRA so that she has $42,000 cash after paying the IRS 33% of the amount withdrawn. To the nearest dollar, how much does she need to withdraw?

10. If the Spurs finish the season with a record of 30 wins and 52 losses, what percent of their games will they have won? Write answer to the nearest 0.1%.

11. The College is eligible to receive a government grant of $8.5 million to start an engineering program. The grant requires that the College's contribution to the new program be 10% of the total budget for the program, with the remainder being the $8.5 million dollars provided by the government. How much money is the College required to provide?

12. Suppose that the Minnesota Meteorologists have won 105 games and lost 55 over the last 10 years. What is their winning percentage for the 10-year period? Express your answer in two ways: (a) as a decimal rounded to the nearest 0.001 and (b) as a percent rounded to the nearest 0.1%.

13. If there are 105 male students for every 55 female students at Northwest Vista College, what percent of the students are females? Round your answer to the nearest 0.1%.

14. Mark Hammer builds houses. The selling price of a house is divided as follows: salesperson, 5%; insurance, 2%; salaries, 25%; advertising, 3%; the rest is used to pay for the lot, the labor, and the materials. What should Mark charge for a house if the lot cost $27,000, the labor was 600 hours at $21.00 per hour, and the materials came to $105,000? Round your answer to the nearest $100.

15. The grades earned in a college algebra class are given below. Fill in the five percents in the third row. Round to the nearest 0.1%.

| Grade | A | B | C | D | F |
|---|---|---|---|---|---|
| Number receiving this grade | 2 | 4 | 12 | 5 | 2 |
| Percent of students who received this grade | | | | | |

16. If 25.3 students fail college algebra for every 100 who pass, what percent of them pass? Write your answer to the nearest 0.1%.

PLEASE WRITE YOUR ANSWERS IN THE LEFT MARGIN

Name_____

1.  Susie Cue bought a pool hall for $219,765. This price includes 5% state tax. What was the price of the pool hall before tax?

2.  In 1999, Amir bought a new television set for $2500. In 2003, he purchased a similar model for $950. What was the percent decrease from 1999 to 2003? Round to the nearest 0.1%.

3.  Cher Kropper needs to put aside enough money at 5% simple interest so that it will grow to $3,000 in one year. What amount will accomplish this goal? Round to the nearest dollar.

4.  Dr. Stella Lemon is selling her BMW 740 on consignment by leaving it with a dealer, who will get 25% of the selling price. What must the selling price be in order for Dr. Lemon's share to be $48,750?

5.  Barry Broke paid a total of $18,900 for his used VW bus. This figure includes $201.60 in fees and 6% sales tax on the actual cost of the truck, which was 10% less than the sticker price. What was the sticker price?

6.  If the Spurs finish the season with a record of 55 wins and 27 losses, what percent of their games will they have won? Write answer to the nearest 0.1%.

7.  If there are 95 male students for every 100 female students at Northwest Vista College, to the nearest 0.1%, what percent of the students are females?

8. Bonus.

Grills Are Us is attempting to stimulate business by offering a "we pay the tax" day. Their advertisement includes the statement, "Come buy $400 barbecue pit without paying any sales tax!"

Even though it appears that the customer pays no tax, Grills Are Us must still send a portion of the $400 to the appropriate taxing authority. Essentially, the $400 that the customer pays includes the tax. Hence, the seller must calculate the *actual* before-tax price of the barbecue pit, which is the price for which the item could have been sold, so that after 8.125% tax is added on, the total would be $400. What is the actual selling price of the barbecue pit, so that the $400 out-the-door price includes the 8.125% tax?

# METRIC SYSTEM

    The units of the modern metric system (SI) are based upon multiples of ten. Thus the conversion from one unit prefix to another merely involves moving the decimal point. As an aid to remembering the order and relative values of the prefixes used in SI, a mnemonic can be invented. A commonly used one is: "Twelve good mannered kids have dropped over dead converting messy metrics nonperfectly." This phrase stands for the prefixes: Tera Giga, Mega, kilo, hecto, deka, base unit, deci, centi, milli, micro, and nano. The base unit ($10^0$ or 1 unit) stands for the various types of units such as meter (m), liter (L) or gram (g). The prefixes are placed in front of the base unit to make a larger or smaller unit.
(Note that "m" by itself means meter but "m" used as a prefix as in "mL" means milli.)

| Twelve | good | mannered | kids | have | dropped | over | dead | converting | messy | metrics | non | perfectly | frequently |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tera | Giga | Mega | kilo | hecto | deka | Base | deci | centi | milli | micro | nano | pico | femto |
| T | G | M | k | h | da | - | d | c | m | μ | n | p | f |
| $10^{12}$ | $10^9$ | $10^6$ | $10^3$ | $10^2$ | $10^1$ | $10^0$ | $10^{-1}$ | $10^{-2}$ | $10^{-3}$ | $10^{-6}$ | $10^{-9}$ | $10^{-12}$ | $10^{-15}$ |
| | | 1000000 | 1000 | 100 | 10 | 1 | 0.1 | 0.01 | 0.001 | 0.000001 | 0.000000001 | 0.000000001 | |

Note that there are 3 decimal places from Tera to giga, giga to mega, mega to kilo, milli to micro, micro to nano, and nano to femto. From kilo to milli, each prefix represents one decimal place.

## EXAMPLES ON USING THIS CHART:

1.    Convert 3 kilometers to centimeters.   3 km = ? cm
Counting from the given prefix kilo to the desired prefix centi is 5 places to the right; therefore, move the decimal point 5 decimal places to the right or add 5 zeros.

             3 0 0 0 0 0

    T G M k h da base d c m μ n p f
             ----------->

C 1

2. How many grams are contained in 25 milligrams? 25 mg = ? g

Counting from the given prefix milli to the desired prefix base unit is 3 places to the left; therefore move the decimal point 3 places to the left from its present position next to the 5 in 25.

T G M k h da base d c m $\mu$ n p f

.025
$\overleftarrow{\phantom{..}}$

$\overleftarrow{\phantom{...}}$

The answer is 0.025 g or 25 x $10^{-3}$ g. (Note: This can also be written as 2.5 x $10^{-2}$ g).

3. How many nanoliters are in 4.5 centiliters? 4.5 cL = ? nL

Counting from the given prefix centi to the desired prefix nano is 7 places to the right - one place for centi to milli, 3 more places for milli to micro and 3 more places for micro to nano.
Therefore, move the decimal point 7 places to the right starting from its present decimal position in 4.5

T G M k h da base d c m $\mu$ n p f

45000000
$\overrightarrow{\phantom{......}}$

$\overrightarrow{\phantom{...}}$

The answer is 45000000 nL or 4.5 X $10^7$ nL.

NOW TRY THESE CONVERSIONS ON YOUR OWN.

1. 88 mm = ____ cm        2. 9.3 mg = ____ kg        3. 760 nm = ____ m        4. 350 mL = ____ L

5. 5.75 MB = ____ kB*      6. 24 mg = ____ $\mu$g        7. 8 ns = ____ ms*      8. 0.35 L = ____ cL

(Note: "B" stands for the base unit bytes and "s" stands for the base unit seconds.)

Answers:

1. 8.8 cm or 88 x $10^{-1}$ cm
   (8.8 cm is more practical. Exponential notation is generally reserved for very large (>$10^3$) or very small (<$10^{-3}$) size values.)
2. 0.0000093 kg or 9.3 x $10^{-6}$ kg      3. 0.00000076 m or 7.6 x $10^{-7}$ m      4. 0.350 L or 3.5 x $10^{-1}$ L
5. 5750 kB or 5.75 x $10^3$ kB            6. 24000 $\mu$g or 2.4 x $10^4$        7. 0.000008 ms or 8 x $10^{-6}$ ms
8. 35 cL

The following prefixes, in combination with the basic unit names, provide the multiples and submultiples in the International System. For example, the unit name *meter*, with the prefix *kilo* added, produces *kilometer*, meaning "1,000 meters."

| Prefix | Symbol | Multiples | Equivalent | Prefix | Symbol | Sub-multiples | Equivalent |
|--------|--------|-----------|------------|--------|--------|---------------|------------|
| yotta | Y | $10^{24}$ | septillionfold | deci | d | $10^{-1}$ | tenth part |
| zetta | Z | $10^{21}$ | sextillionfold | centi | c | $10^{-2}$ | hundredth part |
| exa | E | $10^{18}$ | quintillionfold | milli | m | $10^{-3}$ | thousandth part |
| peta | P | $10^{15}$ | quadrillionfold | micro | m | $10^{-6}$ | millionth part |
| tera | T | $10^{12}$ | trillionfold | nano | n | $10^{-9}$ | billionth part |
| giga | G | $10^{9}$ | billionfold | pico | p | $10^{-12}$ | trillionth part |
| mega | M | $10^{6}$ | millionfold | femto | f | $10^{-15}$ | quadrillionth part |
| kilo | k | $10^{3}$ | thousandfold | atto | a | $10^{-18}$ | quintillionth part |
| hecto | h | $10^{2}$ | hundredfold | zepto | z | $10^{-21}$ | sextillionth part |
| deka | da | 10 | tenfold | yocto | y | $10^{-24}$ | septillionth part |

http://mathforum.org/library/drmath/view/58487.html

Russ Rowlett's *How Many? A Dictionary of Units of Measurement* is a good site for looking up this kind of information. Select D for degree Celsius and degree Fahrenheit. Here's what he says:

degree Celsius
a metric unit of temperature. The Celsius temperature scale is named for the Swedish astronomer and physicist Anders Celsius (1701-1744), who used a similar scale. The freezing point of water (at one atmosphere of pressure) was originally defined to be 0 degrees Celsius, while the boiling point is 100 degrees Celsius. Thus the Celsius degree is 1/100 of the difference between these two temperatures. (The scale actually used by Celsius was inverted, so that 0 degrees Celsius was the boiling point of water and 100 degrees Celsius the freezing point.) In the SI system, the Celsius scale is defined so that the temperature of the triple point of water (the temperature at which water can exist simultaneously in the gaseous, liquid, and solid states) is exactly 0.01 degrees Celsius, and the size of the degree is 1/273.16 of the difference between this temperature and absolute zero (the temperature at which all molecular motion ceases). For practical purposes this is equivalent to the original definition.

degree Fahrenheit
a traditional unit of temperature still used customarily in the United States. The unit was defined by the German physicist Daniel G. Fahrenheit (1686-1736), who also invented the mercury thermometer. Fahrenheit set 0 degrees at the coldest temperature he could conveniently achieve using an ice and salt mixture, and he intended to set 100 degrees at the temperature of the human body. (He was off a little there; normal temperature for humans is between 98 degrees Fahrenheit and 99 degrees Fahrenheit.) On this scale, the freezing point of water (at normal sea level atmospheric pressure) turned out to be about 32 degrees Fahrenheit and the boiling point about 212 degrees Fahrenheit. Eventually, the scale was precisely defined by these two temperatures. One degree Fahrenheit equals 5/9 degrees Celsius, but in converting between scales we have to be careful to adjust the zero points as well. To convert a temperature in degrees Fahrenheit to the Celsius scale, we must first subtract 32 degrees and then multiply by 5/9. In the other direction, to convert a temperature in degrees Celsius to the Fahrenheit scale, we must first multiply by 9/5 and then add 32 degrees. The Celsius scale is now used everywhere outside the United States, so only Americans need to remember these formulas.

Name_____

Zero degrees Celsius corresponds to 32 degrees Fahrenheit and 100 degrees Celsius corresponds to 212 degrees Fahrenheit.

a. Plot the points (0, 32) and (100, 212).

b. Determine the slope of the line through these two points (Cf. p. 39 in your packet).

c. Determine the equation of the line (Cf. p. 43). Write the equation in slope-intercept form: F = ____C + ____

d. Solve the equation for C. Write the answer in the form:
C = ____(F - ____)

e. What is the Celsius equivalent to 98.6 degrees Fahrenheit?

f. What temperature is the same in Celsius as Fahrenheit?

g. Consider this way of converting from one system to the other:

(i) Add 40
(ii) Multiply by 9/5 or 5/9, depending on which way you're converting.
(iii) Subtract 40

Write two equations reflecting these two conversion formulas.
Show that they are equivalent to the equation you got in part c.

Name_____

Use the Internet to fill out this chart.

|  | Miles | Kilometers |
|---|---|---|
| Diameter of earth |  |  |
| Diameter of moon |  |  |
| Diameter of sun |  |  |
| Distance from earth to moon |  |  |
| Distance from earth to sun |  |  |
| Speed of light | Miles per second | Meters per second |

1. If you were to make a two-dimensional scale drawing of the solar system and you decided to represent the earth as a circle one inch in diameter, answer the following questions about the drawing.

   (a) To the nearest 0.25 inch, what would the diameter of the moon be?

   (b) To the nearest inch, how far away would the moon be from the earth?

   (c) To the nearest foot, what would the diameter of the sun be?

   (d) To the nearest foot, how far away would the sun be from the earth?

   (e) To the nearest 0.5 second, how long does it take light from the moon to travel to the earth?

   (f) To the nearest minute, how long does it take light from the sun to travel to the earth?

   (g) If you decided to include the nearest star, Proxima Centauri, which is 4.22 light years away, how far from the sun would it be? Give your answer to the nearest hundred miles.

2. What is the earth's approximate speed in miles per hour as it travels around in the sun? Assume that a year is 365.25 days.

3. What is the moon's approximate speed in miles per hour as it travels around the earth?

3. John's beard grows 3 inches in 200 days. How fast is that in miles per hour?

For the next exercise, go to the site: http://www.onlineconversion.com/ and click on one or more of these links:

Most Popular Conversion Pages
Length, Temperature, Speed, Volume, Weight, Cooking, Area, Fuel Economy, Currency.

| 1 gallon | Quarts |
|---|---|
| 1 gallon | Cubic inches |
| 1 quart | Ounces |
| 1 quart | Pints |
| 1 ounce | Teaspoons |
| 1 ounce | Tablespoons |
| 1 pound | Ounces |
| 1 ton | Pounds |
| 1 foot | Inches |
| 1 yard | Feet |
| 1 mile | Feet |
| 1 light year | Miles |
| 1 pound | Ounces |
| 1 ton | Pounds |
| 1 hundredweight | Pounds |
| 1 square yard | Square feet |
| 1 cubic yard | Cubic feet |
| 1 acre | Square feet |

| 1 inch | Centimeters |
|---|---|
| 1 mile | Kilometers |
| 1 quart | Liters |
| 1 kilogram | Pounds |
| 1 cubic inch | Cubic centimeters |
| 1 cc | Cubic inches |

5. How many cubic inches are in a 1200 cc motorcycle engine?

6. How many cc are in a 429 cubic inch engine?

7. What will be the cost to carpet a room measuring 17 by 15 feet with carpet that sells for $24 per square yard?

1. The cedar posts supporting an old house are to be replaced with 30 concrete supports. The underground portion of each support will be a circular cylinder 9 inches in diameter and 30 inches deep. The above-ground portion of each support will be a rectangular solid 9 by 9 by 20 inches.

   a. What is the volume in cubic inches of one of the concrete supports?

   b. What is the volume in cubic inches of all 30 supports?

   c. What is the volume in cubic yards of all 30 supports?