Remember that when working with equations that whatever you do to one side, you must do to the other side.

Also, when working with unknown quantities, **use variables.**

When solving applied problems, it might be helpful to ask yourself questions to help set-up equations that you can solve. Examples of questions you could ask yourself are given in red below. Keep in mind that the questions below in red will not appear in the homework, or on quizzes and exams; these are simply questions that you should be asking yourself when you see problems like these in order to help get equations that you can solve.

Examples:

1. An employee makes $14 an hour. The employee gets paid double for any hours (or fraction of an hour) worked over 40 hours in a week. One week the employee made $840 before taxes; how many **total** hours did the employee work?

   How much does the employee make for working 40 hours? (hourly wage times 40 hours)

   How many hours over 40 did the employee work? (if you don't know, assign a variable to represent this value)

   How much did the employee make for the hours over 40? (overtime hourly wage times overtime hours)

   How much did the employee make total? (write an equation; $ for 40 hours + $ for overtime = total $)

2. A couple has budgeted $4,000 for the rehearsal dinner for their upcoming wedding. If sales tax is 5% and they tip 20%, how much can they spend on the meal only, before tax and tip, if they tip on the meal only and do include the tax on the meal when calculating the tip? Round your answer to the nearest penny.

What is the cost of the meal only? (if you don't know, assign a variable to represent this value)

How much sales tax will the couple pay? (cost of the meal only times 0.05*)*

How much will the couple pay for the tip? (cost of the meal only times 0.2*, since they're tipping on the meal only)*

How much will the couple pay in total? (write an equation;
$ for the meal only + $ for tax + $ for tip = total $)

3. A couple has budgeted $4,000 for the rehearsal dinner for their upcoming wedding. If sales tax is 5% and they tip 20%, how much can they spend on the meal only, before tax and tip, if they tip on the total bill (dinner + tax)? Round your answer to the nearest penny.

What is the cost of the meal only? (if you don't know, assign a variable to represent this value)

$$x$$

How much sales tax will the couple pay? (cost of the meal only times 0.05)

$$0.05x$$

How much will the couple pay for the tip? (0.2 times (cost of the meal only + tax), since they're tipping on the total bill)

$$0.2(x + 0.05x)$$

How much will the couple pay in total? (write an equation; $ for the meal only + $ for tax + $ for tip = total $)

$$x + 0.05x + 0.2(x + 0.05x) = 4{,}000$$

$$x + 0.05x + 0.2(1.05x) = 4{,}000$$

$$x + 0.05x + 0.21x = 4{,}000$$

$$1.26x = 4{,}000$$

$$x = \frac{4{,}000}{1.26}$$

$$x = 3{,}174.60$$

So the couple can spend $3,174.60 of their $4,000 budget on just the meal, and they'll still have enough to cover the tax on the meal, and the tip.

4. An electrician and his apprentice both work 10 hours on a particular job. If they bill a customer \$735 for labor on a job, and the apprentice pay rate is $\frac{1}{4}$ that of the electrician, how much does **<u>each</u>** make per hour?

How much does the electrician make per hour?

How many hours did the electrician work?

How much does the apprentice make per hour?

How many hours did the apprentice work?

How much did the pair make together? (write an equation; \$ for electrician + \$ for apprentice = total \$)

5. When a popular band played at Elliott Hall, the box-office receipts totaled $120,000. Non-student tickets cost 3 times more than student tickets. If 4,000 students attended the concert, as well as 2,000 non-students, what was the ticket charge for **<u>each</u>**?

How much did student tickets cost ?

$$x \text{ dollars}$$

How many students attended the concert?

$$4{,}000 \text{ students}$$

How much did non-student tickets cost ?

$$3x \text{ dollars}$$

How many non-students attended the concert?

$$2{,}000 \text{ students}$$

How much total box-office revenue was generated? (write an equation; $ from student tickets + $ from non-student tickets = total $)

$$\$ \text{ from students} + \$ \text{ from non} - \text{students} = \text{Total } \$$$

$$\left(x \ \frac{\text{dollars}}{\text{student}}\right) \cdot (4000 \text{ students}) + \left(3x \ \frac{\text{dollars}}{\text{non} - \text{student}}\right)(2000 \text{ non} - \text{students}) = \$120000$$

$$4000x \text{ dollars} + 6000x \text{ dollars} = \$120000$$

$$\$10000x = \$120000$$

$$x = 12$$

So student tickets cost $12 each while non-student tickets cost $36 each.

6. A salesperson purchased a car that is advertised as getting half as many miles per gallon of gasoline in the city than it does on the highway. On a recent sales trip that covered 1200 miles in total, the car used up 25 gallons on the highway and 10 gallons in the city. Assuming that the advertised mileage estimates were correct, what is the mileage of the car in the city and on the highway?

How many miles per gallon does the car get on the highway?

$$x \ \frac{\text{miles}}{\text{gallon}}$$

How many gallons of gas were used on the highway?

$$25 \ \text{gallons}$$

How many miles per gallon does the car get in the city?

$$\frac{1}{2}x \ \frac{\text{miles}}{\text{gallon}}$$

How many gallons of gas were used in the city?

$$10 \ \text{gallons}$$

How many total miles were driven? (write an equation; miles driven on the highway + miles driven in the city = total miles)

$$\text{Highway miles} + \text{City miles} = \text{Total miles}$$

$$\left(x \ \frac{\text{miles}}{\text{gallon}}\right) \cdot (25 \ \text{gallons}) + \left(\frac{1}{2}x \ \frac{\text{miles}}{\text{gallon}}\right)(10 \ \text{gallons}) = 1200 \ \text{miles}$$

$$25x \ \text{miles} + 5x \ \text{miles} = 1200 \ \text{miles}$$

$$30x \ \text{miles} = 1200 \ \text{miles}$$

$$x = 40$$

So the car gets 40 $\frac{\text{miles}}{\text{gallon}}$ on the highway and 20 $\frac{\text{miles}}{\text{gallon}}$ in the city.

Answers to Examples:

1. $50\ hours$;
2. $\$3{,}200$; 3. $\$3{,}174.60$;
4. $Electrician\ makes\ \$58.80\ per\ hour;$
   $Apprentice\ makes\ \$14.70\ per\ hour$;
5. $Student\ tickets\ cost\ \$12\ ; Non-student\ tickets\ cost\ \$36$;
6. $40\ mpg\ on\ the\ Highway\ ; 20\ mpg\ in\ the\ City$;