



## Grade 6 Math Circles

### Fall 2012

### *Applications of Percent*

A **percentage** is a way of expressing a number as a fraction of 100. For example,  $\frac{13}{100} = 13\%$ .

#### How to Convert:

- Decimals to Percentages

Method: **Multiply the decimal number by 100 and add the percent sign**

Examples:

$$0.75 \rightarrow (0.75)(100) \rightarrow 75\%$$

**Exercise 1:** Convert the following decimals into percents.

a)  $0.63 \quad \rightarrow \underline{(0.63)(100) \rightarrow 63\%}$

b)  $0.5 \quad \rightarrow \underline{(0.5)(100) \rightarrow 50\%}$

c)  $1.9 \quad \rightarrow \underline{(1.9)(100) \rightarrow 190\%}$

- Percentages to Decimals

Method: **Divide the percent by 100 and remove the percent sign**

Examples:

$$75\% \rightarrow \frac{75}{100} \rightarrow 0.75$$

**Exercise 2:** Convert the following percents into decimals.

a)  $58\% \quad \rightarrow \underline{\frac{58}{100} \rightarrow 0.58}$

b)  $10\% \quad \rightarrow \underline{\frac{10}{100} \rightarrow 0.1}$

c)  $150\% \quad \rightarrow \underline{\frac{150}{100} \rightarrow 1.5}$

- Fractions to Percentages

Method: [Divide the numerator by the denominator, multiply by 100 and add the percent sign](#)

Examples:

$$\frac{75}{100} \rightarrow \frac{75}{100}(100) \rightarrow 75\%$$

**Exercise 3:** Convert the following fractions into percents.

a)  $\frac{12}{100} \rightarrow \frac{12}{100}(100) \rightarrow 12\%$

b)  $\frac{7}{8} \rightarrow \frac{7}{8}(100) \rightarrow 87.5\%$

c)  $\frac{15}{10} \rightarrow \frac{15}{10}(100) \rightarrow 150\%$

### Finding the Percentage of a Number

When you want to find a percentage of a number, we often convert the percentage into a [decimal](#) and then [multiply](#) the numbers.

Example: Calculate 20% of 200.

- First, change 20% into a [decimal](#):  $20\% \rightarrow \frac{20}{100} \rightarrow 0.2$
- Then, [multiply](#) by 200.  $(0.2)(200) = 40$

Therefore, 20% of 200 is 40.

**Calculate the following:**

1. 10% of 590  $\underline{10\% = 0.1 \rightarrow (0.1)(590) = 59}$

2. 100% of 5  $\underline{100\% = 1 \rightarrow (1)(5) = 5}$

3. 200% of 33  $\underline{200\% = 2 \rightarrow (2)(33) = 66}$

4. 130% of 65  $\underline{130\% = 1.3 \rightarrow (1.3)(65) = 84.5}$

### Applications of Percentages

#### 1. Sales Tax

The government charges taxes on the products that we buy so that they can accumulate money to spend on items such as roads, schools, hospitals and healthcare. In Ontario, this tax is called HST or Harmonized Sales Tax and is [13%](#). With sales tax, we [add](#) a percentage of the original cost of the item(s).

Example: Suppose that we want to buy a costume for Halloween which costs \$30.

- a) How much would the tax be if the item costs \$30 and tax is 13%?

Change 13% into decimal:  $13\% = 0.13$

Then, multiply:  $(30)(0.13) = \$3.90$

- b) How much are we paying in total?

Sale price + tax =  $30.00 + 3.90 = \$33.90$

## 2. Discount

When stores want to clear out older inventory, they often lower their prices so that customers are more inclined to buy the product. The new price of the product is called the sale price and the amount that the stores reduces the price is called the discount.

Normally, stores advertise this discount by indicating that customers get a percentage off of the selling price, which is called the discount rate

Example: A TV originally costs \$300 and the electronic store is advertising that all TVs are 20% off. How much does the TV cost with the markdown (before tax)?

Change 20% into decimal:  $20\% = 0.2$

Then, multiply to find the discount:  $(300)(0.2) = \$60$

Now, subtract to find the sale price:  $300 - 60 = \$240$

## 3. Markup

When you buy an item from a store, you are helping that store make money (profit). The idea is that stores buy their products for a low price (usually in bulk) and then sell those products for a higher price. The price at which the stores buy a product is the cost of the product and the amount that they raise the price is called the markup. The markup rate is the percentage comparing the markup divided by the cost (make sure these are the same units). After the markup, the product is at the selling price.

Example: The variety store near your house buys each chocolate bar for \$1. They then markup the price by 20¢ to make a selling price of \$1.20. What is the markup rate?

$$\text{markup rate} = \frac{\text{markup}}{\text{cost}} = \frac{\$0.20}{\$1.00} = 0.2 = 20\%$$

## 4. Commission

In order to motivate employees, some stores pay their workers by commission. This means that employees get paid a certain percentage for each product that they sell. This percentage is called the commission rate. Therefore, the more products that you sell, the more you get paid. Sometimes, employees get paid an hourly wage as well.

Example: Justin sells bicycles door-to-door and he gets a 20% commission rate on all of his sales.

- (a) Yesterday, Justin sold \$500 worth of bicycles. How much did he earn yesterday?

Change 20% into decimal:  $20\% = 0.2$

Then multiply:  $(500)(0.2) = \$100$

(b) Last month, he made \$6000 of commission. How many bicycles (in dollars) did he sell?

Divide commission by the commission rate:  $\frac{\text{commission}}{\text{commissionrate}} = \frac{\$6000}{0.2} = \$30000$

### Problem Set

1. Jordan bought a toy doll for his sister for her birthday, which cost \$10 (after tax). If he paid \$1 in taxes, what is the tax rate?
2. Matt plays hockey and needs to buy new skates. The sale price of the skates that he wants is \$249.99. However, the store is advertising that all hockey equipment is 15% off of the original sale price.
  - a) How much is discounted off of the skates?
  - b) What is the price of the skates after the discount (before tax)?
  - c) If tax is 12%, how much does Matt have to pay in total?
  - d) What percentage of the original sale price (\$249.99) did Matt have to pay?
3. Maggie wants to buy a bag of candy to hand out for Halloween. The bag of candy costs \$9.99 before tax (which is 8%).
  - a) How much tax does Maggie pay?
  - b) How much does Maggie pay in total?
  - c) It turns out that the candy was on sale and Maggie only paid a total of \$7.55. How much was the candy *before* tax?
4. You just had an amazing meal. The waiter gives you your bill it says \$23.75. You calculated that your meal costs \$20 before taxes. Does the bill make sense if tax is at 13%?
5. How much tax are you paying on a purchase if the price tag says \$15 but you pay \$16.50?
6. Walter paid \$15.35 for his fried chicken. What was the pre-tax cost of his meal if tax is at 11%?
7. Al and Buggy are in the lemonade stand business. It costs Al \$0.25 to make a glass of lemonade, while it takes Buggy \$0.20 (Al's lemonade is better tasting). If they both sell their lemonade at \$1.00 a glass, how much is their individual markup rate?
8. How much would you pay for a \$200 suit at 35% discount?
9. A jacket costs \$250 after discount, down from its original price of \$375. How much was the discount rate?
10. Chester is a real estate agent. On a monthly basis, he gets paid 5% commission for the houses that he sells. How much does he need to sell in order to make \$15000 a month?
11. An item is marked up by 20%, then marked down by 15%, then marked up again by 27%. What single percentage would you have to charge to get the equivalent markup?

12. Dean wants to sell his 1967 Chevy Impala. He offers it a 30% discount off of his original buying price. The customer negotiates another 12% off of the discounted price, but pays an extra \$500 for some cleaning equipment. In total, Dean gets \$6500 from the deal. How much did Dean pay originally for the Impala?
13. Jessica works in a sports store. She gets paid 4% commission as well as \$10 per hour. This morning she started work at 10:00am. She left for lunch at 1:00pm and came back at 2:00pm.
  - a) In the morning, she sold 5 hockey nets for \$500 each, 5 pairs of shoes for \$60 each and a set of 12 uniforms for a total of \$4000. How much did she earn in the morning? (Don't forget the hourly wage!)
  - b) After lunch, she worked until 7:00pm and sold 2 sets of hockey equipment for \$1500 each and 10 soccer balls for \$60 each. What is the total amount that Jessica has earned today?
14. Patty wants to lower the price of her handmade jewellery from \$19 to \$15. What is the discount rate she should advertise?
15. George saw a pair of sandals for \$40 after a 30% discount! What was the original price?
16. Jennifer used to live in Nova Scotia where she sold dreamcatchers for \$11. She now lives in Ontario and wants to sell dreamcatchers. If the sales tax is 15% in Nova Scotia and 13% in Ontario, what price should she set the dreamcatchers at so that customers in Ontario pay the same as what the customers in Nova Scotia paid?
17. Fred sells insurance. He makes \$12 per hour plus 9% commission of whatever he sells. Today, he worked seven hours and sold \$2500 worth of insurance. How much did he earn?
18. You are given a choice between working for \$15 an hour or a 5% commission rate of your sales. How much do you have to sell in an hour so that both salary choices are just as good?
19. You are given a choice between working for either \$30 an hour plus \$150 for showing up or a 15% commission rate of your sales. You can sell \$300 worth of sales in an hour. When is either option equally as good?
20. How much does a discount rate have to be so that the total (after 15% tax) comes to half the original price?
21. Lily wants to buy a ratchet set. She sees a set for \$100 with 30% off. She decides to buy it. When Lily goes to the cashier, she finds out that there is a second discount off of the reduced price, and then an additional \$5 discount off of that. After a 15% tax, Lily pays \$54.62. What was the second discount rate?
22. An item is discounted three times: 30%, 15% then 7%. What single discount rate would reduce the price by the same amount?