## Explore

**Thinking Space**

**Taxes (GST and PST)**

You were so excited to buy that new hoodie! But when you went to pay, the total that came up on the cash register was more than the price on the tag. What happened?

In some provinces two taxes are added to purchases: the Goods and Services Tax (GST) and the Provincial Sales Tax (PST). Other provinces have just one tax, the Harmonized Sales Tax (HST). BC may soon adopt the HST, but in this lesson we’ll explore how to work with two taxes. The current rates are:

* + GST 5%
	+ PST 7%

##### Example 1

A skateboard has a displayed price of $140.00. What is the total amount of taxes on this item? What is the check out price?

5% = 5

100

= 0.05 7% = 7

100

= 0.07

Remember that in math,

multiplication.

“of” means

GST = 5% of $140.00 = 0.05 × 140.00 = $7.00 PST = 7% of $140.00 = 0.07 × 140.00 = $ 9.80

The total amount of taxes = $7.00 + $9.80 = $16.80 The check out price is: $140.00 + $16.80 = $ 156.80

**Note**: The GST and PST are each calculated separately—the calculation of one does not affect the calculation of the other. We could perform these calculations in any order. In fact, we could combine the GST and PST into one total percentage (5% + 7% = 12%).

**Working Backward**

**Thinking Space**

Sometimes we might want to find the price of an item before taxes. To do this we can work backward from the cost of the taxes.

##### Example 2

For example, if we know the GST on an item is $9.00, we can find the original price.

We know the percentage and the cost of the tax, but we don’t know the original amount. In the previous example, we used the following expression to find the tax cost.

original price × percentage tax = tax cost

We can use this same expression, substituting what we know.

original price × 5% = $9.00

OR

original price × 0.05 = $9.00



|  |  |
| --- | --- |
| Solve for the original price:original price  0.05  $9.00 0.05 0.05original price = $180.00 | Divide both sides by0.05 to get“original price” by itself on the left side. |

##### Example 3

You pay $3.00 in taxes on a T-shirt. How much did the T-shirt cost before taxes?

Total taxes include 5% GST + 7% PST = 12% original price × 12% = $3.00

original price × 0.12 = $3.00

original price  0.12  $3.00

*How big do you think the original price will be compared to its taxes? Try estimating before we solve it.*

0.12 0.12

original price = $25.00

The T-shirt cost $25.00 before taxes.

**Thinking Space**

**Try It!**

**Activity 1**

For the questions below, assume that the GST is 5% and the PST is 7%.

1. If the display price of an item is $120.00, what is the
	1. GST paid on the item?
	2. PST paid on the item?
2. If the price tag on a pair of jeans reads $70.00, what is the total amount of taxes? What is the check out price?
3. If the GST paid on a new collector’s edition of a video game is $3.40, what was the original price?

**Thinking Space**

1. If the PST paid on an item is $10.00, what was the original price of the item?
2. If the total tax on an item is $9.60, what was the original price of the item?

## Explore

**Profits, Taxes, and Discounts**

Stores mark up the price on their merchandise to cover expenses, wages, and make a profit. Sometimes a store will decide to mark up an item based on a specific dollar amount. This is called simple markup. Other times, a store will decide on a percentage markup, and apply the same percent markup to similar items. The price that a store sells items at is called the retail price.

Stores often offer discounts in order to get rid of old merchandise or to encourage people to buy more items. There are many ways to offer a discount. One of the most common is a percent discount.

Let’s work through some examples.

##### Example 1 (Simple Markup)

A store buys a box of Wii® accessories for $200.00. The store plans to sell the accessories and wishes to mark it up by $25.00. If you were to purchase the accessories from this store, how much would you pay including taxes?

Solution:

Since the store wants to markup the Wii® accessories by $25.00, the price tag will read $225.00 ($200.00 cost + $25.00 markup = $225.00).

When you purchase the accessories, you also have to pay GST (5%) and PST (7%).

GST = 5% of $225.00 = 0.05 × $225.00 = $ 11.25 PST = 7% of $225.00 = 0.07 × $225.00 = $15.75

So the total cost for you = $225.00 + $11.25 + $15.75 = $252.00.

**Note**: The GST and PST are each calculated separately—the calculation of one does not affect the calculation of the other. We could perform these calculations in any order. In fact, we could combine the GST and PST into one total percentage (5% + 7% = 12%).

To make sure this works, check that you get the same answer.

**Thinking Space**

12% of $225.00 = 0.12 × 225.00 = $27.00

Previously we calculated that the GST was $11.25 and the PST was $15.75. Combining these, you can see that we get $27.00, which is the same answer.

##### Example 2 (Percent Markup)

A store buys hoodies at a wholesale price of $60.00 each. They usually mark up the price of a clothing item by 35%. What is the retail price for the hoodies?

Solution:

The markup is 35% of the wholesale cost.

35% × $60.00 = 0.35 × $60.00 = $21

retail price = cost of item + markup

= $60.00 + $21

= $82.00

The retail price of the hoodies is $82 each.

##### Example 3 (Percent Discount)

A CD regularly sells for $16. You can buy it on sale for 15% off. What is the sale price?

Solution:

sale price = original price – discount amount

= $16 – (15% of $16)

= $16 – (0.15 × $16)

= $16 – $2.40

= $13.60

The sale price is $13.60.

*In what other situations might you be able to combine percents? Are there any situations where this might not work?*

|  |  |
| --- | --- |
| Another way to approach this problem is to consider how much of the original retail price you will be paying. If you are getting a 15% discount, then you are paying 85% of the original price. | 100% - 15% = 85% |

Then,

sale price = 85% of the original price

= 85% × $16

= 0.85 × $16

= $13.60

You get the same answer; the discounted price is $13.60.

##### Example 4 (Percent Discount: Working Backwards)

A pair of jeans is marked down by 20%, and a sale tag now advertises the sale price is $46.40. What was the original price?

Solution:

Sale price = Original Price – (20% of the original price)

Let *x* represent the original price, and substitute the values we know.

$46.80  *x*  (20% of *x*)

$46.80  *x*  0.20*x*

Simplify like terms.

1x – 0.20x = 0.80x.

x = 1x and

$46.80  0.80*x*

$46.40  0.80*x*

0.80 0.80

$58  *x*

The original price of the pair of jeans was $58.00. We can approach this problem another way.

*Can you think of another way to solve the problem? Try setting up a proportion.*

The original price for the item can be considered 100%. If 20% is taken off, that would leave 80% of the price (100% – 20% = 80%).

So, the expression we can use is:

80% of the original price is $46.40.

Try using this expression to solve the problem. You should get the same answer.

##### Example 5 (Combined Discounts)

**Thinking Space**

A portable DVD player usually sells for $150.00 at a local store. The weekend flyer had an advertisement for a 10% discount. You go to check it out and find out that the store is giving a further discount of 20% off any discounted price! What will be the new ticket price?

Solution:

Price after 10% discount = $150.00 – 10% of $150.00

= $150.00 – 0.10 × 150.00

= $150.00 – $15.00

= $135.00

Price after a further 20% discount = $135.00 – 20% of $135.00

= $135.00 – 0.20 × $135.00

= $135.00 – $27.00

= $108.00

So the overall discounted price is $108.00.

**Note**: In Example 1 we found that we could combine the two taxes before figuring out the cost of the taxes. It didn’t matter which order we calculated the taxes, or if we combined them first.

Example 5 is different. In Example 5, there is a discount on a discount. This is called a compounding percent. The order that you calculate these percents is very important, and you cannot simply add the percents together.

**Other Problems**

We have solved several percent problems related to shopping: profits, taxes, and discounts. There are many other applications of percents. The next activity will ask you to solve a number of problems. Some will be similar to the ones we solved in this Explore, but some will be a bit

different. Think through the problems carefully, and use what you know about percents, ratios, and proportions to help you.

*Check it out! Try applying the discounts in a different order, or combining them first before calculating the sale price. You should find that you get a different answer for each.*

For the questions below, assume that the GST is 5% and the PST is 7%.

**Try It!**

**Activity 2**

1. A street vendor buys a pair of jeans wholesale for $90.00 and sells it for $120.00 including taxes. What is the profit amount for the vendor? (GST is 5% and PST is 7%)
2. Cole bought a Blackberry for $300.00 after a 20% discount. What was the original listed price?
3. A classic video game discounted by 10% has been advertised for a further 15% discount. If the original price was $80.00, what was the price of the game after both discounts?
4. A winter jacket has a listed price of $160.00. If the store advertises a discount of 30%, how much does it cost after the discount and the taxes are added? (GST is 5% and PST is 7%)

**Thinking Space**

1. In Grade 10, students face their first provincial exams. The provincial exam is worth 20% of their final mark, the remainder comes from their class grade. Alex is a student in 10th grade. If he has 70% in his class mark and 73% on his provincial exam, what mark does he get for a final grade in the course?
2. Most of the water on Earth is saltwater. Only approximately 2.5% of the water on Earth is freshwater. Two thirds of that freshwater is frozen in icecaps and glaciers. Our drinking water comes from freshwater sources such as groundwater, rivers, and lakes.
	1. What percent of the Earth’s freshwater is frozen? (Express your answer to the nearest hundredth.)
	2. What percent of the Earth’s water is available to us for use? (Express your answer to the nearest hundredth.)

**Thinking Space**