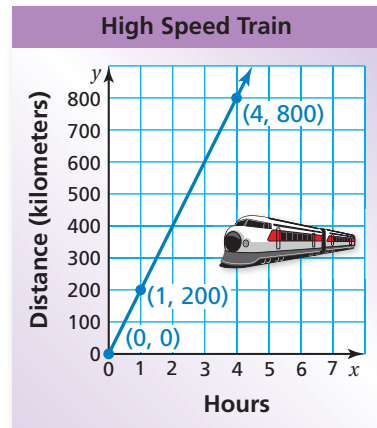# 3.7b Proportional Relationships

EXAMPLE **1** **Interpreting a Proportional Relationship**

The distance traveled by a high speed train is proportional to the number of hours traveled. Interpret each plotted point in the graph.

High Speed Train

$(0, 0)$: The train travels 0 kilometers in 0 hours.

Study Tip

In the graph of a proportional relationship, you can find the unit rate from the point $(1, y)$.

$(1, 200)$: The train travels 200 kilometers in 1 hour.

This point represents the unit rate, $\dfrac{200 \text{ km}}{1 \text{ h}}$, or 200 kilometers per hour.
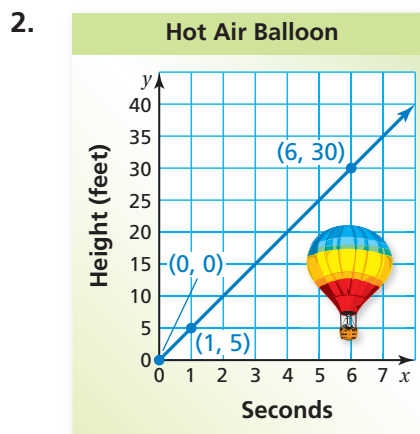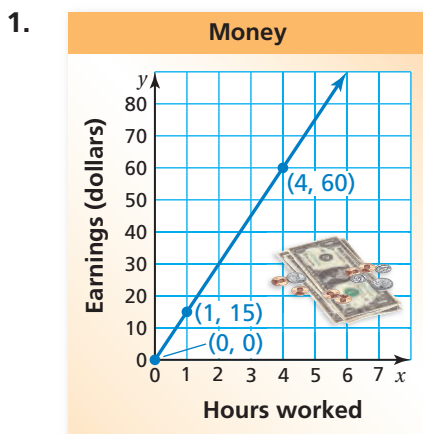
$(4, 800)$: The train travels 800 kilometers in 4 hours.

Because the relationship is proportional, you can also use this point to find the unit rate.

$$\frac{800 \text{ km}}{4 \text{ h}} = \frac{200 \text{ km}}{1 \text{ h}}, \text{ or 200 kilometers per hour}$$

Practice
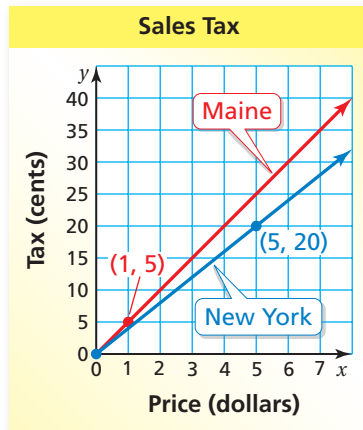
Interpret each plotted point in the graph of the proportional relationship.

1.

Money

2.

Hot Air Balloon

3. **REASONING** The graph of a proportional relationship passes through $(3, 4.5)$ and $(1, y)$. Find y.

EXAMPLE 2 **Comparing Graphs of Proportional Relationships**

Sales Tax

The state sales taxes in Maine and New York are proportional to the price of a purchase, as shown in the graph.

a. Express the sales tax rate for each state as a percent.

> *Maine:* (1, 5) indicates that the tax is 5 cents per dollar.
>
> $$\frac{5 \text{ cents}}{1 \text{ dollar}} = \frac{5 \text{ cents}}{100 \text{ cents}} = 5\%$$
>
> *New York:* (5, 20) indicates that the tax is 20 cents per 5 dollars.
>
> $$\frac{20 \text{ cents}}{5 \text{ dollars}} = \frac{4 \text{ cents}}{1 \text{ dollar}} = \frac{4 \text{ cents}}{100 \text{ cents}} = 4\%$$

⋮ Maine has a 5% sales tax and New York has a 4% sales tax.

b. What is the sales tax on a $12 purchase in New York?

> **Method 1:** Write and solve a proportion to find the sales tax.
>
> $$\frac{20}{5} = \frac{y}{12}$$ ← cents ← dollars   Use (5, 20) to write a proportion.
>
> $$48 = y$$ Multiply each side by 12.

⋮ The sales tax on a $12 purchase in New York is 48 cents.

> **Method 2:** Find 4% of $12.
>
> 4% of $12 = 0.04 • 12   Write 4% as a decimal.
>
> = 0.48   Multiply.

⋮ The sales tax on a $12 purchase in New York is $0.48, or 48 cents.

Practice

4. COMMISSION The graph shows that the commissions of two salesmen are proportional to the amounts of sales.

  a. Express the commission rate for each salesman as a percent.

  b. What commission does Salesman A receive for a $10,000 sale?

  c. How much more commission does Salesman A receive than Salesman B for a $10,000 sale?

Commission