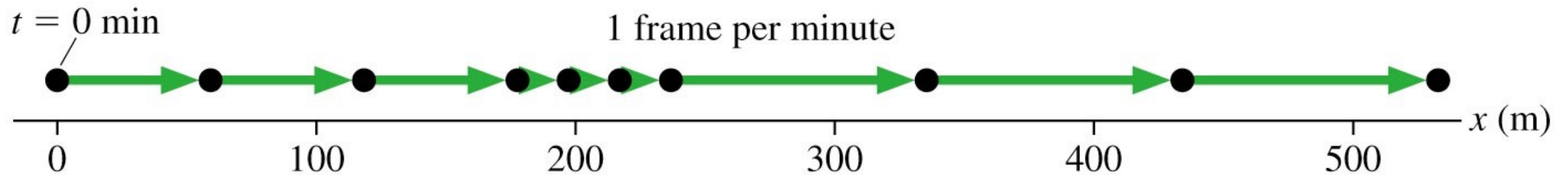


Position vs. Time Graphs

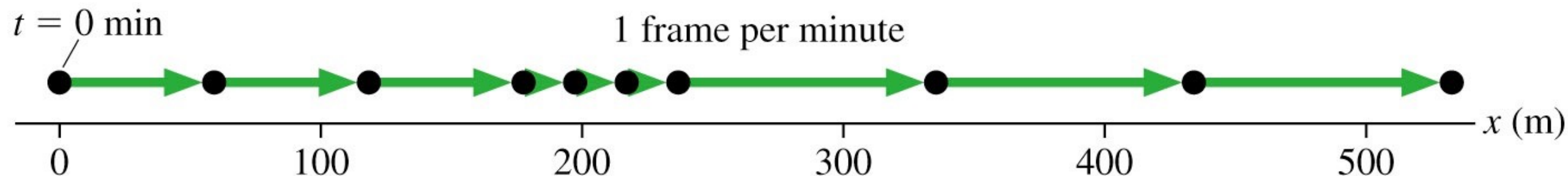
- Below is a motion diagram, made at 1 frame per minute, of a student walking to school.



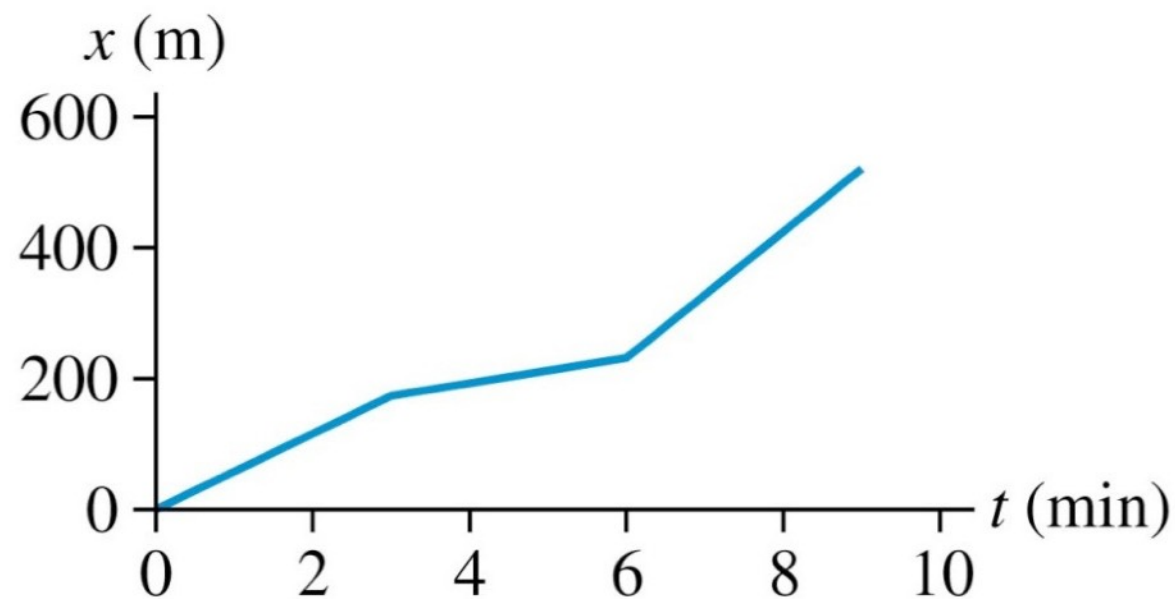
Can you draw the position vs. time graph for this motion?

Position vs. Time Graphs

- Below is a motion diagram, made at 1 frame per minute, of a student walking to school.

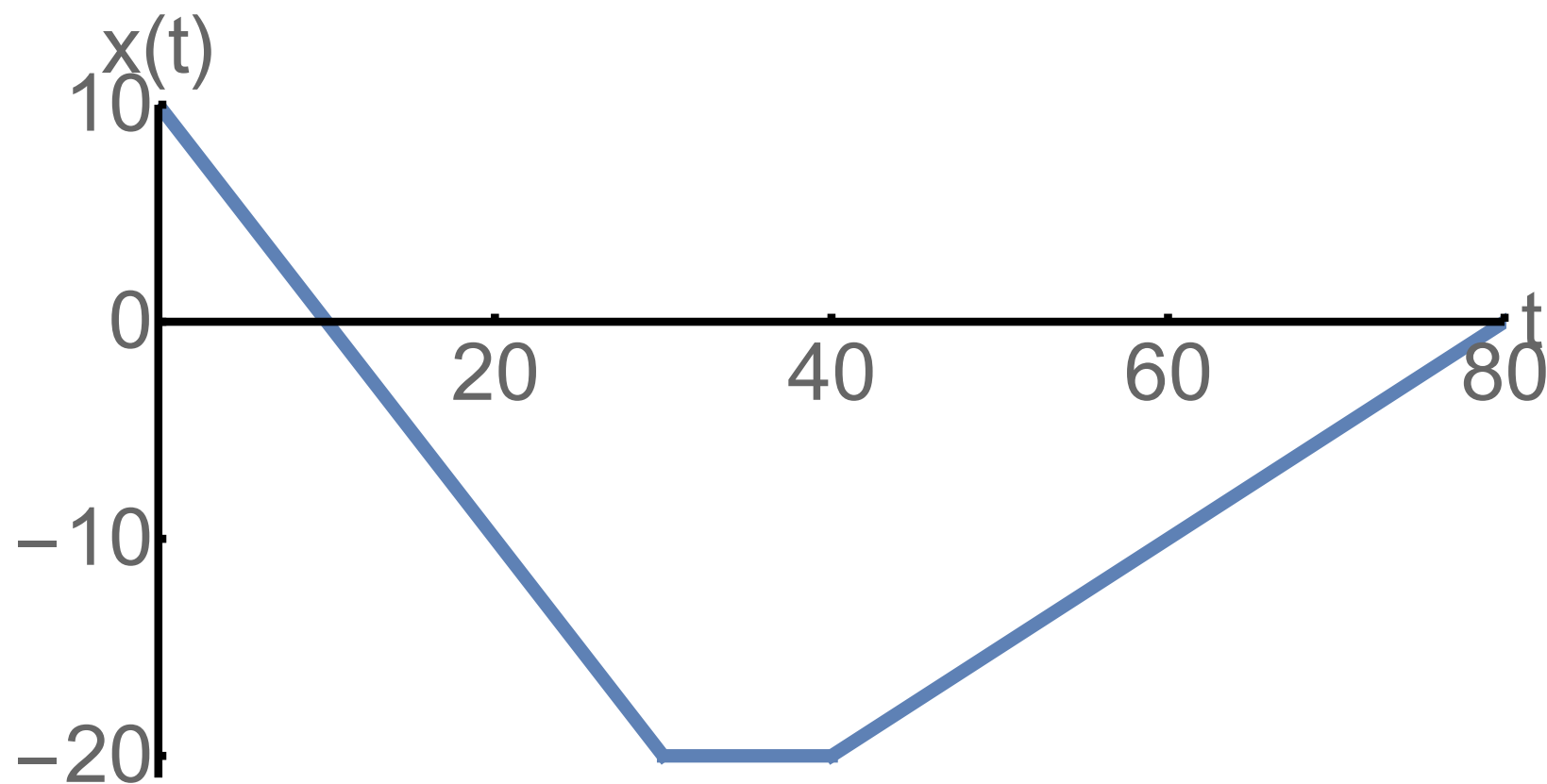


Can you draw the position vs. time graph for this motion?

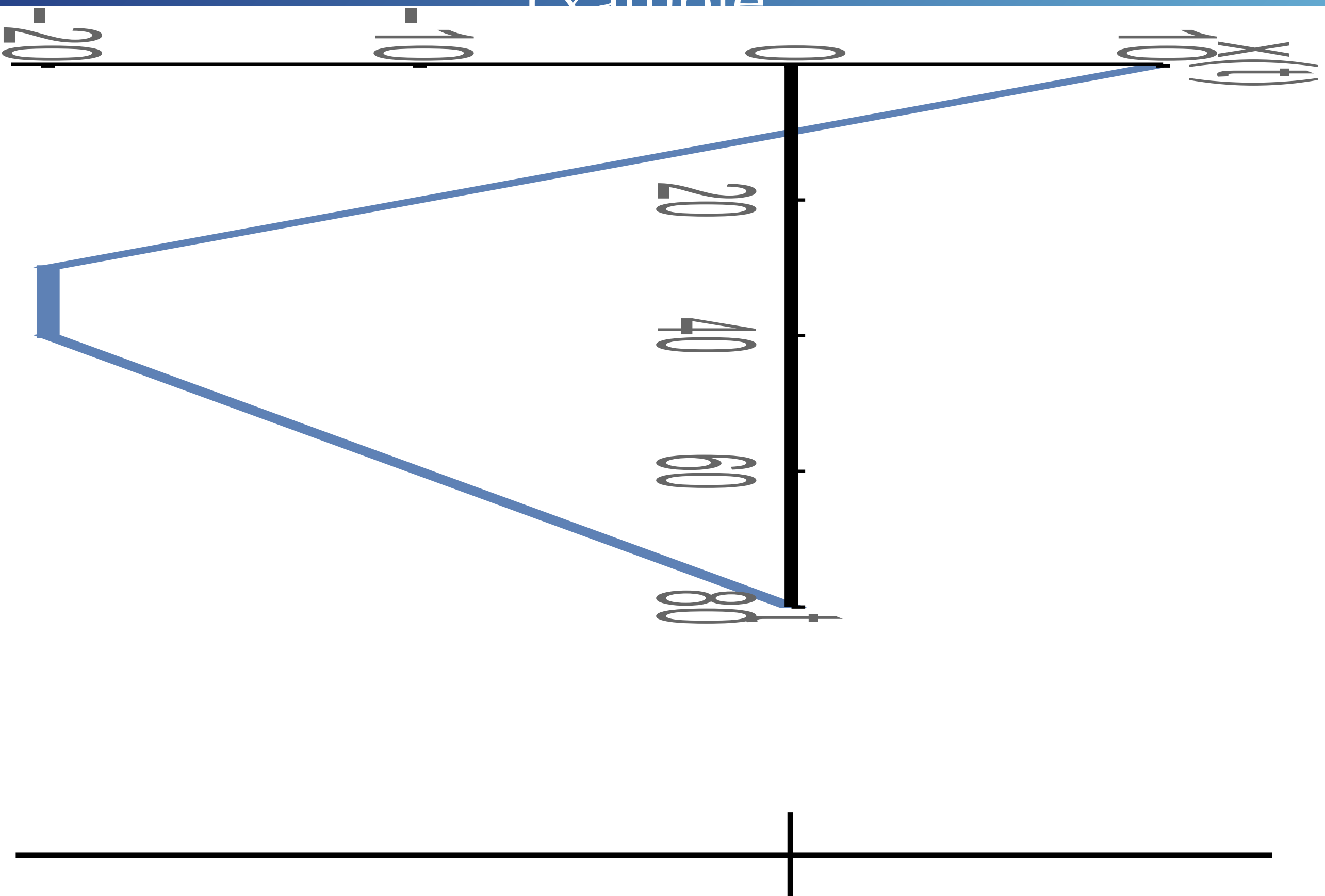


Example

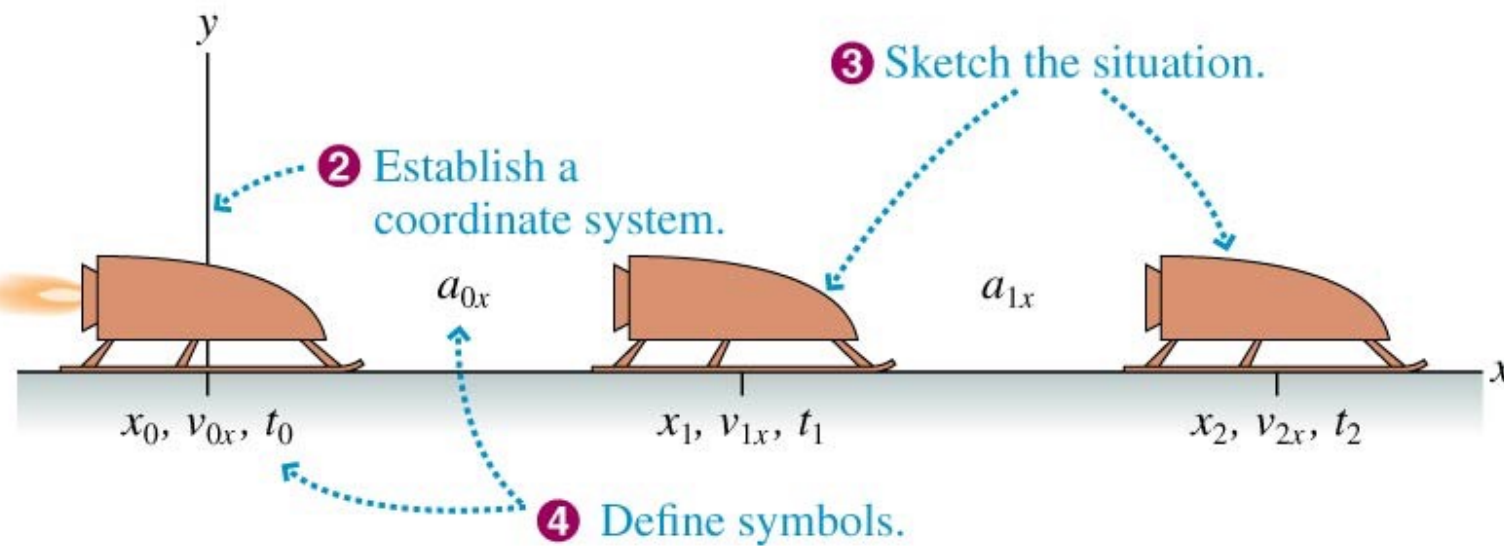
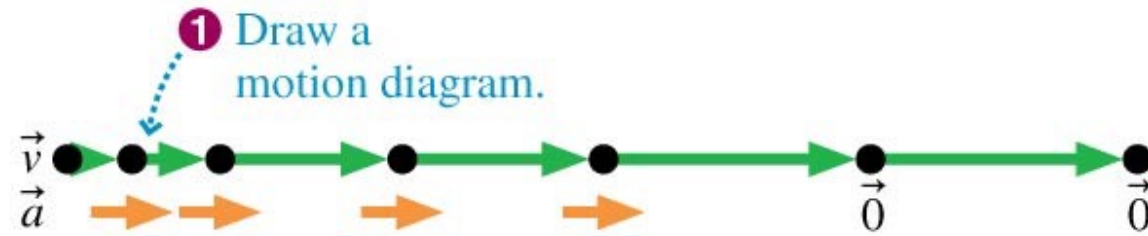
The graph represents the motion of a car along a straight road. Can you draw the motion diagram.



Example



Solving Problems in Physics



5 List known information.

6 Identify desired unknown.

Known

$$x_0 = 0 \text{ m} \quad v_{0x} = 0 \text{ m/s}$$

$$t_0 = 0 \text{ s}$$

$$a_{0x} = 50 \text{ m/s}^2$$

$$t_1 = 5.0 \text{ s}$$

$$a_{1x} = 0 \text{ m/s}^2$$

$$t_2 = t_1 + 3.0 \text{ s} = 8.0 \text{ s}$$

Find

$$x_2$$

Unit Conversions

Show your neighbor how to convert 2.00 ft to meters

Useful unit conversions

$$1 \text{ in} = 2.54 \text{ cm}$$

$$1 \text{ mi} = 1.609 \text{ km}$$

$$1 \text{ mph} = 0.447 \text{ m/s}$$

$$1 \text{ m} = 39.37 \text{ in}$$

$$1 \text{ km} = 0.621 \text{ mi}$$

$$1 \text{ m/s} = 2.24 \text{ mph}$$

Unit Conversions

Show your neighbor how to convert 2.00 ft to meters

$$2.00 \text{ ft} \times \frac{12 \text{ in}}{1 \text{ ft}} \times \frac{2.54 \text{ cm}}{1 \text{ in}} \times \frac{10^{-2} \text{ m}}{1 \text{ cm}} = 0.610 \text{ m}$$

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Show your neighbor how to convert 5.00 ft/min² to meters/s²

$$5 \frac{\text{ft}}{\text{min}^2} \times \frac{12 \text{ in}}{1 \text{ ft}} \times \frac{0.0254 \text{ m}}{1 \text{ in}} \times \frac{1 \text{ min}^2}{60^2 \text{ s}^2} = 4.2 \times 10^{-4} \frac{\text{m}}{\text{s}^2}$$

Useful unit conversions

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$$1 \text{ mi} = 1.609 \text{ km}$$

$$1 \text{ mph} = 0.447 \text{ m/s}$$

$$1 \text{ m} = 39.37 \text{ in}$$

$$1 \text{ km} = 0.621 \text{ mi}$$

$$1 \text{ m/s} = 2.24 \text{ mph}$$

Track your units

$$x_f = x_i + \overset{\text{m/s}}{v_i} \overset{s}{\Delta t} + \frac{1}{2} \overset{\text{m/s}^2}{a} \overset{s}{\Delta t}^2$$

What will be the units of your result?

Track your units

$$x_f = x_i + \overset{\text{m/s}}{v_i} \overset{s}{\Delta t} + \frac{1}{2} \overset{\text{m/s}^2}{a} \overset{s}{\Delta t}^2$$

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What will be the units of your result?

$$x_f = x_i + \overset{\text{m/s}}{v_i} \overset{\text{h}}{\Delta t} + \frac{1}{2} \overset{\text{cm/s}^2}{a} \overset{\text{h}}{\Delta t}^2$$

What will be the units of your result?

Track your units

$$v = \frac{\overset{\text{m}}{\Delta x}}{\underset{\text{s}}{\Delta t}}$$

What will be the units of your result?

Track your units

$$v = \frac{\overset{\text{ft}}{\Delta x}}{\underset{\text{h}}{\Delta t}}$$

What will be the units of your result?

Significant figures

What is the difference between these numbers?

3.654

3.65473921956

Significant figures

What is the difference between these numbers?

3.654

$3.654 \pm .0005$

3.65473921956

$3.65473921956 \pm .0000000000005$

Significant Figures

Leading zeros locate the decimal point.
They are not significant.

$$0.00620 = 6.20 \times 10^{-3}$$

A trailing zero after the decimal place is reliably known. It is significant.

The number of significant figures is the number of digits when written in scientific notation.

- The number of significant figures \neq the number of decimal places.
- In whole numbers, trailing zeros are not significant. 320 is 3.2×10^2 and has 2 significant figures, not 3.
- Changing units shifts the decimal point but does not change the number of significant figures.

Quiz

Rank in order, from the most to the least, the number of significant figures in the following numbers. For example, if b has more than c, c has the same number as a, and a has more than d, you would give your answer as $b > c = a > d$.

a. 8200

b. 0.0052

c. 0.430

d. 4.321×10^{-10}

- a. $d > c > b = a$
- b. $a = b = d > c$
- c. $b = d > c > a$
- d. $d > c > a > b$
- e. $a = d > c > b$

Quiz

Rank in order, from the most to the least, the number of significant figures in the following numbers. For example, if b has more than c, c has the same number as a, and a has more than d, you would give your answer as $b > c = a > d$.

a. 8200

b. 0.0052

c. 0.430

d. 4.321×10^{-10}

2? Ambiguous

2

3

4

a. $d > c > b = a$

b. $a = b = d > c$

c. $b = d > c > a$

d. $d > c > a > b$

e. $a = d > c > b$

Significant Figures Rules

1. When multiplying or dividing numbers, or taking roots, the number of significant figures in the result should match the number of significant figures in the least precisely known number used in the calculation.
2. When adding or subtracting numbers, the number of decimal places in the answer should match the smallest number of decimal places of any number used in the calculation.
3. To eliminate round-off error it is acceptable to keep a few extra digit for intermediate calculations and truncate the final answer to the correct number of significant figures.

Why do we do significant figures?

$$3.5932 + 8.1$$

$$3.5932 \pm .0001 + 8.1 \pm .1$$

What is the max/min/mid value this sum could be?

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$$3.5931 + 8.0 = 11.5931 \text{ (min)}$$

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$$3.5933 + 8.2 = 11.7933 \text{ (max)}$$

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$$3.5931 + 8.0 = 11.5931 \text{ (min)}$$

To what decimal place should we round our answer?

Example

An object consists of two pieces. The mass of one piece has been measured to be 6.47 kg. The volume of the second piece, which is made of aluminum, has been measured to be $4.44 \times 10^{-4} \text{ m}^3$. A handbook lists the density of aluminum as $2.7 \times 10^3 \text{ kg/m}^3$. What is the total mass of the object?

$$\text{Recall that } \rho = \frac{m}{V}$$