

Name: _____

Period: _____

Ch. 1:1

**Word Problem Primer -
How to Solve Word Problems**

“How R U?”

You know that this means “How are you?”. It is shorthand, abbreviation, “code”; it is a quicker way to write. Well, so is $F=ma$; you just don’t know *the code* yet.

$F = ma$
*Formulas are just
shorthand.*

Learn what the letters stand for.

In order to read “the code” you have to know what the letters stand for. This table will tell you many of them.

There will be other letters, too. You will have to add them as you learn them.

Variables Defined with Units		
Variable	Quantity	Standard Units
a	acceleration	m/s^2
D	distance	m (meters)
E	energy	J (joules)
F	force	N (newtons)
F_w	force of weight	N (newtons)
g	acceleration due to gravity	$g = 9.8 m/s^2$
m	mass	kg (kilograms)
p	momentum	kgm/s
S	speed	m/s
T	time	sec, min, or hr
v	velocity	m/s
MA	mechanical advantage	no units

$$F = ma$$

*F is force (in N)
m is mass (in kg)
a is acceleration
(in m/s^2)*

The units are VERY important because word problems will not tell you what letters stand for, but the UNITS will..

Learn what you’re supposed to do with the letters: math.

Once you know what the letter mean, you have to know what math function to perform. This table will tell you.

The Math Code		
$m + a$	is add	means m plus a
$m - a$	is sub	means m minus a
ma	is multi	means m times a
m/a	is div	means m divided by a

$$F = ma$$

*Means Force equals
the mass times
the acceleration.*

Learn how to move the numbers around in the formulas. (There is a formula chart on the back.)

Often you will have to solve for a different letter in the formula. You will have to know how to use math to do this.

To Move Letters in Formulas	
If $m + a$	then subtract by m or a
If $m - a$	then add by a
If ma	then divide by m or a
If m/a	then multiply by a

Make sure what ever you do to one side of an equation do to the other side, too or the equation is no longer equal!

$$\text{If } F = ma$$

Then to get “a”, divide by “m” on both sides:

$$\frac{F}{m} = \frac{ma}{m}$$

m’s cancel on right side

$$\text{So, } a = \frac{F}{m}$$

Use a five-step process to solve word problems.

5 Steps to Solve Word Problems	
Step 1	Assign letters (variables) to the numbers given
Step 2	Find a formula that uses those variables
Step 3	Solve for the letter you are trying to find
Step 4	Put the numbers in for the variables (letters)
Step 5	Calculate an answer (don't forget units)

We will do a few examples on the back of this paper.

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Δ means "change of" ("delta"). So ΔS is "delta S" and means "change of speed". ΔT is change of time.

Formula Chart

(Add other formulas here)

$S = \Delta D / \Delta T$ $A = \Delta S / \Delta T$ $\Delta T = T_2 - T_1$ $\Delta D = D_2 - D_1$ $S_{\text{average}} = D_{\text{total}} / T_{\text{total}}$	$F_{\text{net}} = ma$ $F_{\text{net}} = F_{\text{pos}} - F_{\text{neg}}$ $F_w = mg$ $p = mv$ $m_L v_L = m_R v_R$	$MA = F_{\text{out}} / F_{\text{in}}$ $MA = D_E / D_R$ $\text{Arm}_{\text{in}}(F_{\text{in}}) = \text{Arm}_{\text{out}}(F_{\text{out}})$		
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Use the units to match the variables on the left with the quantities on the right		What do these variables mean?		What is Δ and what does it mean?	
1. a = _____	35 joules	1. E _____		What is ΔD and what does it mean?	
2. S or v = _____	20 meters/sec	2. a _____			
3. m = _____	5 meters	3. S _____		A car starts 3 meters away and ends up 14 meters away. What is ΔD for the car?	
4. D = _____	43 newtons	4. D _____			
5. F = _____	6	5. F _____		A car leaves at 2:00 p.m. and arrives at 4:30 p.m. Find ΔT .	
6. p = _____	3 m/s ²	6. p _____			
7. T = _____	60 kgm/s	7. T _____			
8. E = _____	76 sec	8. MA _____			
9. MA = _____	9 kilograms	9. v _____			
		10. m _____			
Fill in the math functions $ma = m$ _____ a $S/T = S$ _____ T $T_2 - T_1 = T_2$ _____ T_1 $mv = m$ _____ v $F/m = F$ _____ m $T_1 + T_2 = T_1$ _____ T_2 $D_{\text{total}} / T_{\text{total}} = D_{\text{total}}$ _____ T_{total}		How do you break these up? $S = \Delta D / \Delta T$ To move ΔT you would have to: _____ $T = T_2 - T_1$ To move T_1 you would have to: _____ $F = ma$ To move m you would have to: _____ $A = \Delta S / \Delta T$ To move ΔT you would have to: _____ $p = mv$ To move v you would have to: _____ $D = D_2 - D_1$ To move D_1 you would have to: _____ $S_{\text{average}} = D_{\text{total}} / T_{\text{total}}$ To move T_{total} you would have to: _____			
Equation: $\Delta T = T_2 - T_1$; solve for T_2 .		Equation: $F = ma$; solve for a .		Equation: $S = \Delta D / \Delta T$; solve for ΔD .	
				Equation: $A = \Delta S / \Delta T$; solve for ΔT .	
A car travels 40 meters in 10 seconds. Calculate the car's speed.		A car starts at rest and accelerates to 50 m/s in 5 seconds. Calculate acceleration.		A car travels at 60 mph for 10 hours. Calculate the distance it travels.	
Step 1: variables	Step 3: Solve for final variable	Step 1:	Step 3:	Step 1:	Step 3:
	Step 4: Put in numbers		Step 4:		Step 4:
Step 2: formula	Step 5: Calculate answer	Step 2:	Step 5:	Step 2:	Step 5:

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To learn to solve word problems from this page you can do either one of two things:

1) You can read the problem and try to solve it by yourself then check the answer.

OR

2) You can cover up the answers and uncover each step as the page progresses.

Problem 1:A 25 kg box is pulled by a 125 newton force.
What acceleration will it have?

Step 1: assign letters (variables) to the numbers given and to what you are looking for:

$$m = 25 \text{ kg} \quad F = 125 \text{ N} \quad a = ?$$

Step 2: Find an equation that fits these variables:

 $F = ma$ (Newton's second law) - means m multiplied by a

Step 3: Solve for the variable you are looking for:

(Note: If the equation is already solved for what you are looking for [like the F in $F = ma$] you can skip this step.)Since ma is multiplication, then to get a by itself, divide by a on both sides:

$$\frac{F}{m} = \frac{ma}{m} \quad \text{and the } m\text{'s cancel on the right side}$$

$$\text{So: } a = \frac{F}{m} \quad \text{which means } a = F \div m$$

Steps 4 and 5: Put the numbers in and calculate an answer:

$$a = \frac{F}{m} = \frac{125 \text{ N}}{25 \text{ kg}} = 5 \text{ m/s}^2 \quad \text{- remember that acceleration is in m/s}^2 \text{ (look on the letter chart).}$$

Problem 2:

A plane stops from 250 m/sec in 10 seconds. What was its acceleration?

Step 1: assign variables to the numbers given and to what you are looking for:

$$S_1 = 250 \text{ m/s} \quad S_2 = 0 \text{ m/s} \\ \Delta T \text{ (change of time)} = 10 \text{ secs.} \\ a = ?$$

Step 2: Find an equation that fits these variables:

$$\text{Here we have 2 equations: } \Delta S = S_2 - S_1 \text{ and } a = \frac{\Delta S}{\Delta T}$$

Step 3: Solve for the variable you are looking for:
(For this problem we don't have to do this step.)Steps 4 and 5: Put the numbers in and calculate an answer:
To calculate the acceleration, first we must get ΔS .

$$\text{So, } \Delta S = 0 \text{ m/s} - 250 \text{ m/s} = -250 \text{ m/s} \\ \text{(the } \Delta S \text{ is negative because it stops from 250 m/s)}$$

$$\text{So, } a = \frac{\Delta S}{\Delta T} = \frac{-250 \text{ m/s}}{10 \text{ s}} = -25 \text{ m/s}^2$$

Problem 3:A lever has an input arm of 25 m and an output arm of 5 m.
How much force would it take to lift a 100N with this lever?

$$\text{Step 1: } \text{Arm}_{\text{in}} = 25 \text{ m} \quad \text{Arm}_{\text{out}} = 5 \text{ m} \quad F_{\text{out}} = 100 \text{ N} \quad F_{\text{in}} = ?$$

$$\text{Step 2: } \text{Arm}_{\text{in}}(F_{\text{in}}) = \text{Arm}_{\text{out}}(F_{\text{out}})$$

Step 3: since $\text{Arm}_{\text{in}}(F_{\text{in}})$ means multiplication, divide both sides by Arm_{in} : $\text{Arm}_{\text{in}}(F_{\text{in}})/\text{Arm}_{\text{in}} = \text{Arm}_{\text{out}}(F_{\text{out}})/\text{Arm}_{\text{in}}$ Arm_{in} cancels on the left giving: $F_{\text{in}} = \text{Arm}_{\text{out}}(F_{\text{out}})/\text{Arm}_{\text{in}}$ Step 4 and 5: $F_{\text{in}} = 5 \text{ m}(100 \text{ N})/25 \text{ m}$ or $5\text{m} \times 100\text{N} \div 25\text{m}$
(use a calculator!)

$$F_{\text{in}} = 20 \text{ m}$$

Problem 4:

A 40 kg boy throws a 2 kg ball to the left. The boy ends up going to the right a 2 m/s. How fast is the ball going?

$$\text{Step 1: } m_{\text{ball}} = 2 \text{ kg} \quad v_{\text{ball}} = ? \quad m_{\text{boy}} = 40 \text{ kg} \quad v_{\text{boy}} = 2 \text{ m/s}$$

$$\text{Step 2: } m_L v_L = m_R v_R \quad (\text{boy is } m_R \text{ and } v_R, \text{ ball is } m_L \text{ and } v_L)$$

$$\text{Step 3: solve for } v_L \text{ (ball)} \quad m_L v_L = m_R v_R$$

$$\text{divide both sides by } m_L \quad m_L v_L / m_L = m_R v_R / m_L$$

$$m_L \text{'s cancel on the left giving: } v_L = m_R v_R / m_L$$

$$\text{Step 4 and 5: } v_L = 40\text{kg} (2\text{m/s}) / 2\text{kg} = (80\text{kgm/s}) / 2 \text{ kg}$$

$$\text{kgs cancel out giving us: } v_L = 40 \text{ m/s}$$

 Δ means "change of" (name is "delta").So ΔS is "delta S" and means change of speed.**Formula Chart**

(Add other formulas here)

$S = \Delta D / \Delta T$ $A = \Delta S / \Delta T$ $\Delta T = T_2 - T_1$ $\Delta D = D_2 - D_1$ $S_{\text{average}} = D_{\text{total}} / T_{\text{total}}$	$F_{\text{net}} = ma$ $F_{\text{net}} = F_{\text{pos}} - F_{\text{neg}}$ $F_w = mg$ $p = mv$ $m_L v_L = m_R v_R$	$MA = F_{\text{out}} / F_{\text{in}}$ $MA = D_E / D_R$ $\text{Arm}_{\text{in}}(F_{\text{in}}) = \text{Arm}_{\text{out}}(F_{\text{out}})$		
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