MAP4C **Date: ____________**

Day 2: Rearranging formulas to Solve Problems

Unit 6: Algebraic Models

Sometimes we need to solve for a variable that isn't already by itself. To do this we rearrange the equations using an ***INVERSE OPERATIONS*** method. This means you "undo" or "reverse" what is in front of you. Order of operations (BEDMAS) are performed in **reverse** order.

TYPE 1: *Single step Equations*

1. *In this types of equations, the coefficient of x is 1. Simply there is only one x. Example x vs. 2x*

Solve for *x*.

a) $x+6=7$ $-6 \quad -6$ $\boxed{x=1}$	b) $x-3=2$ $+3 \quad +3$ $\boxed{x=5}$	c) $2x=16$ $\div 2 \quad \div 2$ $\boxed{x=8}$	d) $\frac{x}{4}=-6$ $x \div 4 \times 4 = -6 \times 4$ $\boxed{x=-24}$

TYPE 2: *Multi step Equations*

2. *When the coefficient of x is different than one, we follow the opposite of BEDMAS …Start with subtraction or addition before multiplication or division.*

USING ARROW DIAGRAM

$2x^2 - 4 = 28$, solve for x.

Step 1: Sketch an arrow diagram that shows you which steps to take to get to the answer 28.

$$x \xrightarrow{\text{(1) square}} \quad \xrightarrow{\text{(2) multiply by 2}} \quad \xrightarrow{\text{(3) subtract 4}} 28$$

Step 2: Now, update your diagram that shows you which steps to take to get to x from 28.

$$x \xrightarrow{\text{(1) square}} \quad \xrightarrow{\text{(2) multiply by 2}} \quad \xrightarrow{\text{(3) subtract 4}} 28$$

$$\xleftarrow[\text{(3) square root}]{} \quad \xleftarrow[\text{(2) divide by 2}]{} \quad \xleftarrow[\text{(1) add 4}]{}$$

Step 3: Apply these operations to both side of your original equation

$2x^2 - 4 = 28$

$+4 \quad +4$ (1) Add 4 to both sides

$2x^2 = 32$

$\div 2 \quad \div 2$ (2) Divide both sides by 2

$x^2 = 16$

$\sqrt{} \quad \sqrt{}$ (3) Square root both sides

$x = 4$

Solve for *x*. *You can use arrow diagram to assist you visually.*

a) $2x+5=9$ $-5 \quad -5$ $2x=4$ $\div 2 \quad \div 2$ $\boxed{x=2}$	b) $3x-7=5$ $+7 \quad +7$ $3x=12$ $\div 3 \quad \div 3$ $\boxed{x=4}$	c) $4x^2 - 4 = 12$ $+4 \quad +4$ $4x^2=16$ $\div 4 \quad \div 4$ $x^2=16$ $\boxed{x=4}$	d) $3x^2 + 3 = 78$ $-3 \quad -3$ $3x^2=75$ $\div 3 \quad \div 3$ $x^2=25$ $\sqrt{} \quad \sqrt{}$ $\boxed{x=5}$

REARRANGING FORMULAS

Formulas usually express one variable in terms of one or more variables. We can use our knowledge of equations and inverse operations to rewrite the formula in terms of a different variable.

EXAMPLE 1: Rearrange each formula to isolate variable *P*.

$A = P + I$

$-I \quad -I$

$A - I = P$

$A = 2P$

$\div 2 \quad \div 2$

$\frac{A}{2} = P$

$\sqrt{A} = \sqrt{P^2}$ $\quad \sqrt{\ }$ B.S.

$\sqrt{A} = P$

$A = 2P^2 + I$

$P \xrightarrow{\text{square}} \xrightarrow{\times 2} \xrightarrow{+I} A$

$A \xrightarrow{-I} \xrightarrow{\div 2} \xrightarrow{\sqrt{\ }} P$

$A = 2P^2 + I$

$-I \qquad -I$

$\frac{A-I}{2} = \frac{2P^2}{2}$

$\sqrt{\frac{A-I}{2}} = \sqrt{P^2}$

$\sqrt{\frac{A-I}{2}} = P$

EXAMPLE 2: Rearrange V = lwh to isolate h.

$\frac{V}{lw} = \frac{lwh}{lw}$

$\frac{V}{lw} = h$

$h \xrightarrow{\text{multiply } lw} V$

$V \xrightarrow{\text{divide by } lw} h$

EXAMPLE 3: Rearrange E = IR (Ohm's Law) to isolate R.

$\frac{E}{I} = \frac{IR}{I}$

$\frac{E}{I} = R$

$R \xrightarrow{\times I} E$

$E \xrightarrow{\div I} R$

SOLVING PROBLEMS BY REARRANGING FORMULAS

Substitute given value, then rearrange.

Convert 30°C to degrees Fahrenheit. Use the formula $C = \frac{5(F-32)}{9}$. → Sub 30 for C

$30 = \frac{5(F-32)}{9}$

$F \xrightarrow{-32} \xrightarrow{\times 5} \xrightarrow{\div 9} 30$

$30 \xrightarrow{① \times 9} \xrightarrow{② \div 5} \xrightarrow{+32} F$

both sides

$30 \times 9 = \frac{5(F-32)}{9} \times 9$ ① $\times 9$ B.S.

② $\div 5$ B.S

$270 = 5(F-32)$

$\div 5 \qquad \div 5$

$54 = F - 32$ ③ $+32$ B.S

$+32 \qquad +32$

$\boxed{86° = F}$

∴ It is 86°F

EXAMPLE 4: The area, A, of a circle with radius r is given by A = πr^2. Use the formula to determine the radius of a circular oil spill that covers an area of 5.0 km^2.

$5 = \pi r^2$

$r \xrightarrow{\text{square}} \xrightarrow{\times \text{ by } \pi} 5$

$5 \xrightarrow{① \div \pi} \xrightarrow{② \sqrt{\ }} r$

$\frac{5}{\pi} = \frac{\pi r^2}{\pi}$

① divide by π

② $\sqrt{\ }$ B.S.

$1.5915 = r^2$

$\sqrt{\ } \qquad \sqrt{\ }$

$1.26 \cong r$

∴ radius is 1.26 km.

COMPLETE: page 354 #2, 4, 9, 11, 12, 14 – 16