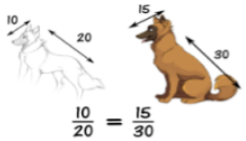
MATH9 OVERVIEW
(MFM1P & MPM1D combined)

Name: _____

NSA1: Number Sense & Proportion



$\frac{10}{20} = \frac{15}{30}$

Fractions	Decimals	Diagram	Out of 100	Percentages
1/10	0.1		10/100	10%
2/10	0.2		20/100	20%
3/10	0.3		30/100	30%
4/10	0.4		40/100	40%
5/10	0.5		50/100	50%

RATE — UNIT RATE

$\frac{24 \text{ miles}}{4 \text{ days}} \div \frac{4}{4} \quad \frac{6 \text{ miles}}{1 \text{ day}}$

$\frac{-x^4 - 5x}{x + (-1)^3}$ for $x = -2$

$x^a x^b = x^{a+b}$

$x^a/x^b = x^{a-b}$

$(x^a)^b = x^{ab}$

$(xy)^a = x^a y^a$

$(x/y)^a = x^a/y^a$

$x^{-a} = 1/x^a$

$x^0 = 1$

NSA2: Expressions & Solving Equations

$5x^2 + 10xy - 14x$

$a^2 + b^2 = c^2$

$3^2 + b^2 = 5^2$

$9 + b^2 = 25$

$-9 \quad -9$

$\sqrt{b^2} = \sqrt{16}$

$b = 4\text{cm}$

$4x + 10 = 2x - 5$

$-2x \quad -2x$

$2x + 10 = -5$

$-10 \quad -10$

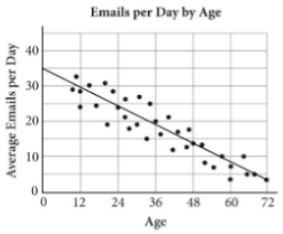
$\frac{2x}{2} = \frac{-15}{2}$

$x = -7.5$

$2x(3x - 4) = 6x^2 - 8x$

x	3x	-4
2x	$6x^2$	-8x

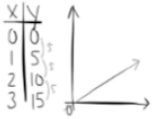
LR1: Linear Relationships



DIRECT

$y = mx$

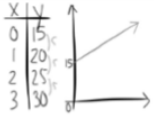
x	y
0	0
1	5
2	10
3	15



PARTIAL

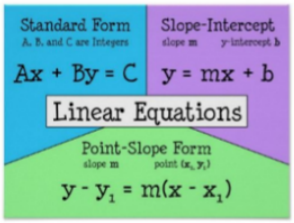
$y = mx + b$

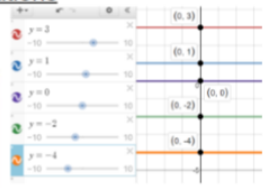
x	y
0	15
1	20
2	25
3	30

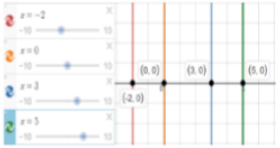


LR2: Characteristics of Linear Relationships

AG1: Forms of Linear Equations







AG2: Slope & y-intercept

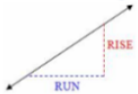
initial value (y-intercept)

$y = mx + b$

x	y
0	15
1	20
2	25
3	30

rate of change (slope)

Slope = $\frac{Rise}{Run}$



$m = \frac{y_2 - y_1}{x_2 - x_1}$

AG3: Solving Linear Problems

LR3: Representing Linear Relationships

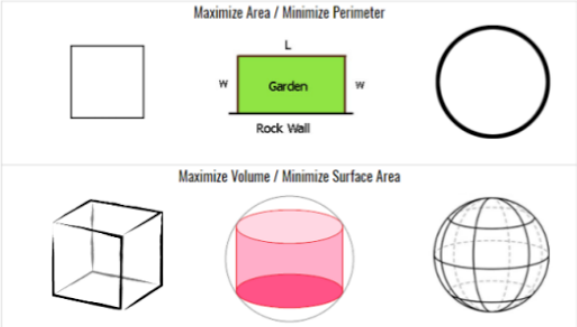
initial value (y-intercept)

$y = mx + b$

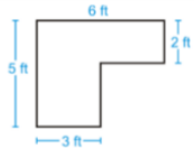
x	y
0	15
1	20
2	25
3	30

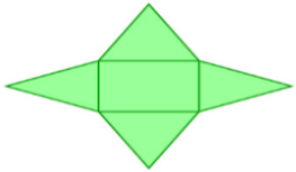
rate of change (slope)

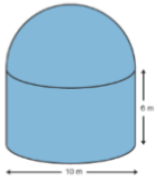
MG1: Optimization

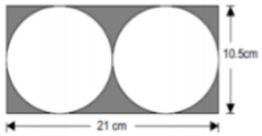


MG2: Perimeter, Area, Volume, & Surface Area

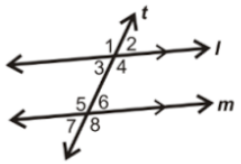


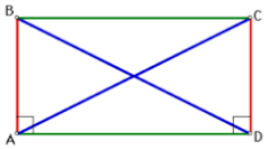


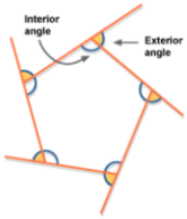




MG3: Geometric Relationships







NSA1 Exponents & Proportions **(Number Sense & Algebra)**

Equivalent ratios	Proportion	Direct proportion/variation
Unit rate	Ratio	x vs x^2 vs x^3
Solve problems involving ratios, rates, directly proportional relationships, percents, fractions & decimals.	Set up proportions	Solve for an unknown value in a proportion
Zero exponents	Negative exponents	Substitute into & evaluate algebraic expressions involving exponents
Multiplying monomials with exponents	Dividing monomials with exponents	Simplify power of a power

NSA2 Expressions & Solving Equations **(Number Sense & Algebra)**

Order of operations	Distribution	Like terms

Simplify numerical expressions	Substitute into equations and solve for one variable	Solve equations using inverse operations	Add & subtract polynomials
Multiply a polynomial by a monomial	Expand & simplify polynomial expressions	Rearrange formulas	Model scenarios with equations

LR1 Data Management **Linear Relations**

Scatter plot	Line of best fit
Collect, organize & analyze data	Describe trends & relationships in data

LR2 Characteristics of Linear Relations **Linear Relations**

Linear	Non-linear	First differences
Line/Curve of best fit	Rate of change	Initial Value
Direct variation	Partial variation	Create tables of values, graphs, & equations

LR3 Representing Linear Relationships **Linear Relationships**

Rate of change	Initial value	rise/run
Describe the scenario for a given graph	Connect representations (words, tables, graphs, & equations)	Describe the effects of changing the rate of change or initial value

AG1 Forms of Linear Equations **Analytic Geometry**

Standard form	Slope / y-intercept form	Horizontal line equation	Vertical line equation
Recognize linear VS non-linear equations		Convert standard form to slope / y-intercept form	

AG2 Slope & y-intercept **Analytic Geometry**

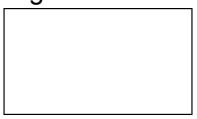
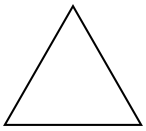
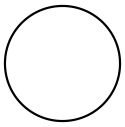
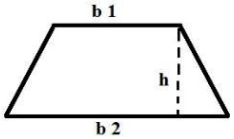
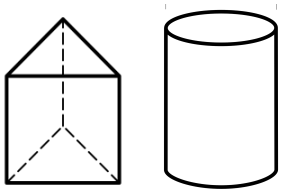
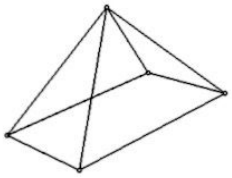
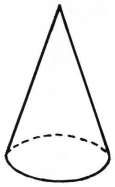
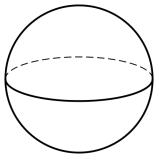
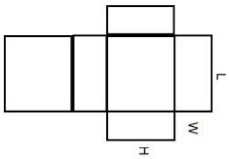
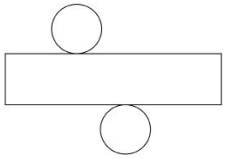
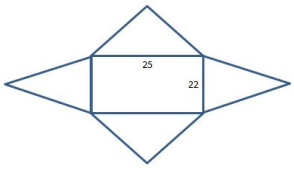
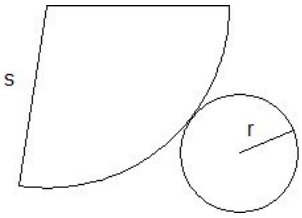
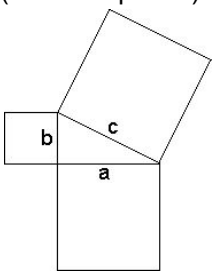
Slope	y-intercept	$y=mx+b$
Calculate the slope of a line	Determine the steepness & direction of a line from its slope	Determine the parallelism or perpendicularity of a line from its slope

AG3 Solving Linear Problems **Analytic Geometry**

Determine the equation of a line (from the slope & a point or from 2 points)	Identify & explain any restrictions on the variables
Graph lines by hand from the equation	Determine the point of intersection of two linear relations graphically

MG1 Optimization	Measurement & Geometry
Determine the maximum area of a rectangle for a given perimeter	Determine the minimum perimeter of a rectangle with a given area.
Determine the maximum volume of a square-based prism or cylinder given a fixed surface area.	Determine the minimum surface area of a square-based prism or cylinder given a fixed volume.

MG2 Perimeter, Area, Surface Area & Volume **Measurement & Geometry**

Rectangle  $P = add\ all\ sides$ $A = l \times w$	Triangle  $P = add\ all\ sides$ $A = \frac{b \times h}{2}$	Circle  $P = 2\pi r$ $A = \pi r^2$	Trapezoid  $P = add\ all\ sides$ $A = \frac{(b^1+b^2)h}{2}$
Volume of a prism  $V = area\ of\ base \times height$	Volume of a pyramid  $V = \frac{Area\ of\ base \times height}{3}$	Volume of a cone  $V = \frac{area\ of\ base \times h}{3}$	Volume of a sphere  $V = \frac{4\pi r^3}{3}$
Surface area of a prism  *SA = add areas of all faces* 	Surface area of a pyramid  *SA = add areas of all faces*	Surface area of a cone  $SA = A_{base} + \pi rs$	Surface area of a sphere $SA = 4\pi r^2$
Pythagorean Theorem (sum of squares)  	Perimeter & Area of 2D shapes	Determine the area & perimeter of composite 2-D shapes	Determine the volume & surface area of composite 3-D shapes

MG3 Geometric Relationships **Measurement & Geometry**

Interior angle of a polygon	Exterior angle of a polygon	Transversal
Vertically opposite angles	Corresponding angles	Consecutive interior angles
Alternate interior angles	Alternate exterior angles	
Determine the interior & exterior angle measures in a polygon	Determine the angle measures formed by parallel lines cut by a transversal	Investigate properties of polygons

Communicating

Explanations Conventions
Notations Terminology

- *Can you explain this another way?*
- *Have you organized your work step by step? Are the steps numbered? Did you label each step?*
- *Did you explain your thinking along the way?*
- *Have you used symbols, keywords & formatting that everyone in your class would understand?*

Selecting Tools & Computational Strategies

Tools:

- Calculator
- Graphing calculator or software (e.g. Desmos)
- Databases & statistical programs (e.g. Excel)
- Dynamic geometry software (e.g. Geogebra)
- Manipulatives (e.g. algebra tiles, linking cubes)

Computational Strategies:

- Mental math
- Estimation
- Algorithms (+, -, x, ÷, ...)

Which one(s) did you use? Why?

Reasoning & Proving

explore phenomena
develop ideas
make a hypothesis
investigate → generalize
extend the pattern
justify results
formulate a proof

Have you verified your answer?

Specific Case(s) —Inductive→ General Rules or Principles
Deductive

Connecting

- *Describe a similar/simpler problem you've solved before & how you solved it.*
- *What prior knowledge do you have that can help help you solve this problem?*
- *How do the different representations I used connect with each other?*
- *Which math concepts or procedures are related to this problem?*
- *When/How would we use this math in daily life?*

REFLECTING

- *Is your answer reasonable? How do you know?*
- *How close was your estimate?*
- *Is there another way of solving?*
- *Which method is most effective/efficient?*
- *What did you find easy/hard?*
- *Did you make any errors in calculation or thinking?*
- *How would your answer change if . . . ?*

Representing

concrete materials	algebraic
	geometric
pictures	dynamic software
diagrams	
graphs	charts
tables	words
numbers	symbols

- *Have you used as many representations as you can?*
- *Which representation seems best? Why?*

PROBLEM SOLVING

What do I know?
What do I need to find out?

What is my plan?

Solve it!

Answer and Explain

Strategies:

physical model	list
diagram	logical reasoning
pattern	table
guess & check	work backwards
make an assumption	chart