

Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas  $V = s^3$  and  $A = 6s^2$  to find the volume and surface area of a cube with sides of length  $s = 1/2$ .*

# LESSON: REAL STORIES OF THE AIF

## How fast was the driver going?

The ability to evaluate expressions and use formulas is a tool that will be necessary for students in not only future math and science courses but in their future in the real world as well. In *Real Stories of the AIF*, Investigator Tricia Harding is a traffic accident investigator. She is looking into an incident where a driver was alleged to be going over the speed limit, almost hitting the alleged victim's pet rabbit (which has possibly suffered psychological damage). During the investigation, Harding discovered the tire friction marks from the scene and determines that she can use a formula to find the driver's speed. The data provided are a page from Investigator Harding's notebook showing the data she collected from the scene and a page from her Accident Investigation Force manual including the "30df" formula and a drag factor table.

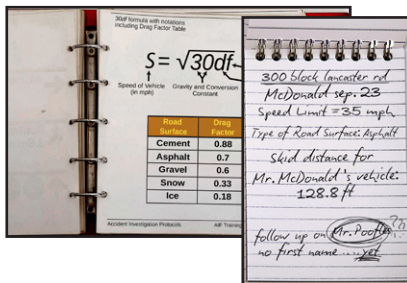
[Download the Detailed Lesson Plan](#)  
Available on the [Teacher Dashboard](#)

### The Math Simulator™



#### 1 Immersion

- Play *Real Stories of the AIF Immersion* video, whole-class.
- Restate the question: **How fast was the driver going?**
- Facilitate classroom discussion; ask students: "What do we need to know?"



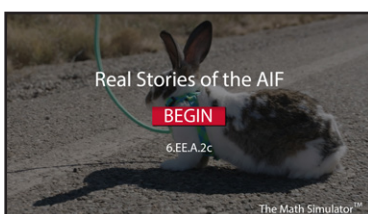
#### 2 Data & Computation

- Print the *Data Artifact*, cut into halves, and distribute to students.
- Allow students work time. Ask students: "Does your answer make sense?"
- Consider using a sharing protocol leading to mathematical insights and/or highlighting misconceptions.
- Allow students to revise their work.



#### 3 Resolution

- Play *Real Stories of the AIF Resolution* video, whole-class.
- Prepare and give brief lecture (*Teacher Instruction*).



#### + Simulation Trainer (Use student headphones.)

- Assign the *Simulation Trainer*.
- Use protocols that encourage students to help each other.
- Use *Progress Monitoring* to access real-time data for the classroom.
- Provide individual help for students who are not making progress.

Instruction at a Glance



**Gladys Graham**



**Kevin Simpson**



**Megan LeBleu**

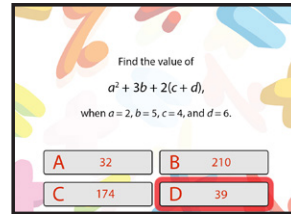
**Gladys:** This standard can be used to introduce the idea of formulas for real-life concepts such as area, perimeter, volume and others.

**Kevin:** Give students opportunities to evaluate expressions for decimal and fraction values, in addition to whole number values.

**Megan:** Sometimes students are confused about the function of the fraction bar. Help them understand that it can be used as both a grouping symbol, to be evaluated first, and as a division symbol.

Standard Math Procedures

Ex. Clicker Quiz #2



- 1 Replace variables.  
 $(2)^2 + 3(5) + 2(4 + 6)$
- 2 Evaluate using order of operations.  
 $(2)^2 + 3(5) + 2(10)$   
 $4 + 15 + 20$   
 $19 + 20$   
 $39$

Clicker Quiz

Launch the *Clicker Quiz*, whole-class.

Investigator Harding received another report of a traffic incident. Using this information from her notebook and manual, how fast was the driver going, to the nearest whole number?

$s = \sqrt{30df}$

400 West Parkside Ave  
Westington, OH 43081  
Speed Limit = 40 mph  
Type of Road Surface: Asphalt  
Skid Distance for Mr. Westington's vehicle = 332.5 ft

A 29 mph    B 53 mph  
C 2,783 mph    D 64 mph

Find the value of  $a^2 + 3b + 2(c + d)$ , when  $a = 2$ ,  $b = 5$ ,  $c = 4$ , and  $d = 6$ .

A 32    B 210  
C 174    D 39

A taxi driver uses the expression  $\$2t + \$0.25m$  to calculate the total cost of a ride, where  $t$  is the time in minutes it takes to complete the trip and  $m$  is the miles traveled.

If a trip takes 15 minutes and is a distance of 7 miles, what is the total cost of the ride?

A \$31.75    B \$3.90  
C \$17.75    D \$52.50

Use the formula  $A = 6s^2$  to find the surface area of a cube with side lengths  $s = 2.1$  units.

A 10.46 sq. units  
B 26.46 sq. units  
C 24 sq. units  
D 158.76 sq. units

Find the total perimeter for the rectangle below if  $w = 6$  feet and  $l = 14$  feet.

$4l + 2w$

A 88 feet    B 92 feet  
C 176 feet    D 184 feet

Joan's school is holding a walk-a-thon to earn money for charity. Sponsors donate \$5.00 plus \$0.50 per mile walked.

If Joan walks 22 miles, how much money would her sponsor donate?

A \$5.50    B \$110.50  
C \$27.50    D \$16.00



## REAL STORIES OF THE AIF

### How fast was the driver going?

Once again Investigator Tricia Harding is looking into a speeding incident. This time it was snowing and the victim said the driver seemed to be going over the speed limit when they skidded to a stop.

Investigator Harding went out to investigate the scene and her measurements can be found below.

Help Investigator Harding determine how fast the driver was going and if they were speeding.

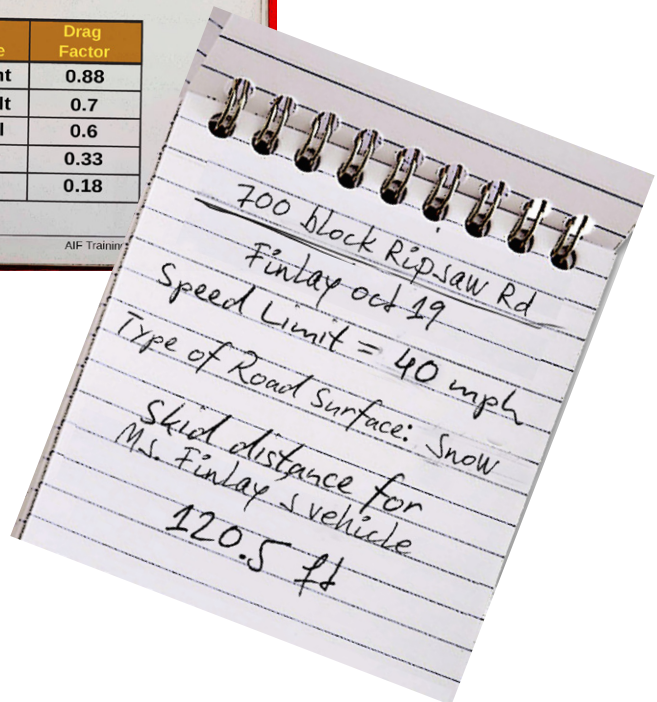
30df formula with notations including Drag Factor Table

$$S = \sqrt{30df}$$

$S$  ← Speed of Vehicle (in mph)  
 $30$  ← Gravity and Conversion Constant  
 $d$  ← Skidmark Distance (in feet)  
 $f$  ← Drag Factor

Road Surface	Drag Factor
Cement	0.88
Asphalt	0.7
Gravel	0.6
Snow	0.33
Ice	0.18

Accident Investigation Protocols AIF Training



### 6.EE.A.2c

#### About this standard

Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas  $V = s^3$  and  $A = 6s^2$  to find the volume and surface area of a cube with sides of length  $s = 1/2$ .

# APPLYING THE STANDARD

How might this standard appear on a test?



CHECK OUT MY WORKED EXAMPLE #5

- 1) Complete the chart using the formula for area of a triangle,  $A = \frac{1}{2}bh$ .

Base	Height	Area
4	3	
2.2	3.24	
6	8	
22	15	
3.1	5.2	

- 2) Evaluate each expression in the chart if  $a = 2, b = 4, c = 6,$  and  $d = 3$ .

$\frac{b}{a} + c^2 - d$	
$d(a^2 - b) + 3c$	
$\frac{b+c}{a} + \frac{d}{a}$	
$(d - a) + 2(b + c)$	
$\frac{1}{2}(3a + d)$	
$2(c + a)^2$	

- 3) The cost of a pass to the amusement park for 5 days or less is  $\$50 + 10n$ , where  $n$  is the number of days you are visiting. The cost for a pass to the amusement park for more than 5 days is  $\$45 + 10(n - 1)$ , where  $n$  is the number of days you are visiting.

a) If you plan on visiting for 5 days, what is the cost of the pass?

b) What would be the cost for visiting for 6 days?

c) Is it a better deal to visit for 5 or 6 days? Explain.

d) What would be the cost to visit for one week?

- 4) What happens to the value of each expression as  $x$  increases?

a)  $x + 2$

b)  $\frac{2}{x}$

c)  $2x$

- 5) The formula to calculate the area of a trapezoid is:  $A = \frac{1}{2}(b_1 + b_2)h$ .

Calculate the area of a trapezoid with  $b_1 = 5$  units,  $b_2 = 12$  units, and  $h = 7$  units.