GRADE 7 ACCELERATED · UNIT 4 · LESSONS 7–8

# Real-World Order of Operations

**MA.8.NSO.1.7**

I can substitute values into a formula and evaluate it, reading what the situation does rather than hunting for key words.

# Warm-Up

1. $-5^2 + (-5)^2$
2. $\sqrt{144} + 2^{-1}$
3. Find the value: $\left(\frac{3}{4}\right)^{-1}$
4. Evaluate $2x^2$ when $x = 3$.

# Warm-Up

1. $-5^2 + (-5)^2$ **0**
2. $\sqrt{144} + 2^{-1}$ **25/2**
3. Find the value: $\left(\frac{3}{4}\right)^{-1}$ **4/3**
4. Evaluate $2x^2$ when $x = 3$. **18**

# Vocabulary

**formula**

a rule written with letters, such as $K = \frac{1}{2}mv^2$,

that becomes a number once each letter is replaced by a value

**substitute**

replace a letter with its value — in parentheses, so that a negative value keeps its sign and a power stays attached to the whole value

**unit**

what the answer is counted in: feet, dollars, joules. A real-world answer without a unit is not an answer

# Notes

## I. Substituting: the value goes in parentheses

$$K = \frac{1}{2}mv^2 \quad \text{with} \quad m = 60 \quad \text{and} \quad v = 10:$$

$$\frac{1}{2}(60)(10)^2 = \frac{1}{2}(60)(100) = 3{,}000 \quad \text{joules}$$

$$\text{with} \quad x = -4: \quad x^2 = (-4)^2 = 16, \quad \text{never} \quad -4^2 = -16$$

**Substitute in parentheses, then evaluate by the structure — powers before products.**

# Notes

## II. Key words do not decide the operation

15 dollars plus 4 dollars for each of 6 gigabytes:

$$15 + 4(6) = 39$$

15 dollars for each of 4 lines, plus 6 dollars of tax:

$$15(4) + 6 = 66$$

**The same words, the same numbers, different structures. Read the situation.**

# Notes

## III. Round once, at the end — and say the unit

$$6\sqrt{200} = 84.8528\ldots \approx 84.85 \quad \text{feet}$$

rounding the side to 14 first: $6(14) = 84$ feet

**Carry the exact value, round once at the end, and write the unit.**

# Example 1

Kinetic energy is $K = \frac{1}{2}mv^2$,

for mass $m$ in kilograms and speed $v$ in meters per second.

Find $K$ for a car of mass 1,200 kg travelling at 15 m/s.

**Give the answer with its unit.**

# Example 1

$$K = \frac{1}{2}(1{,}200)(15)^2$$

$$= \frac{1}{2}(1{,}200)(225)$$

$$= 600(225) = 135{,}000$$

**Answer: 135,000 joules**

# Your Turn

Find $K = \frac{1}{2}mv^2$ for $m = 850$ kg and $v = 12$ m/s.

# Your Turn

Find $K = \frac{1}{2}mv^2$ for $m = 850$ kg and $v = 12$ m/s.

$$v^2 = 12^2 = 144$$

$$K = \frac{1}{2} \times 850 \times 144 = 425 \times 144 = 61{,}200$$

**Answer: 61,200 joules**

# Example 2

A square floor of side 9 feet is carpeted.

Carpet is 2.89 dollars a square foot and padding is 0.75 dollars a square foot.

Installation is a flat 95 dollars. Find the total cost.

# Example 2

$$9^2(2.89 + 0.75) + 95$$

$$= 81(3.64) + 95$$

$$= 294.84 + 95 = 389.84$$

**Answer: 389.84 dollars**

# Your Turn

A square bathroom floor of side 6 feet is tiled.

Tile is 4.25 dollars a square foot and grout is a flat 13.48 dollars.

Find the total cost.

# Your Turn

A square bathroom floor of side 6 feet is tiled.

Tile is 4.25 dollars a square foot and grout is a flat 13.48 dollars.

Find the total cost.

Area: $6^2 = 36$

Tile: $36 \times 4.25 = 153$

Total: $153 + 13.48 = 166.48$

**Answer: 166.48 dollars**

# Whiteboards · Question 1 of 9

Evaluate $3x^2$ when $x = -2$.

**Answer it.**

# Whiteboards · Question 1 of 9

Evaluate $3x^2$ when $x = -2$.

$$3x^2 = 3(-2)^2$$

$$(-2)^2 = 4$$

$$3 \times 4 = 12$$

**Answer: 12**

# Whiteboards · Question 2 of 9

A cyclist has a mass of 70 kilograms and rides at 8 meters per second.

Her bicycle cost 480 dollars.

Kinetic energy is $K = \frac{1}{2}mv^2$, for a mass $m$ and a speed $v$.

**Find her kinetic energy.**

**Answer it.**

# Whiteboards · Question 2 of 9

A cyclist has a mass of 70 kilograms and rides at 8 meters per second.

Her bicycle cost 480 dollars.

Kinetic energy is $K = \frac{1}{2}mv^2$, for a mass $m$ and a speed $v$.

**Find her kinetic energy.**

$$K = \frac{1}{2} \times 70 \times 8^2 = 35 \times 64 = 2{,}240$$

**Answer: 2,240 joules**

# Whiteboards · Question 3 of 9

Renting a kayak costs 17 dollars plus 9 dollars for each hour.

Find the cost of 3 hours.

**Answer it.**

# Whiteboards · Question 3 of 9

Renting a kayak costs 17 dollars plus 9 dollars for each hour.

Find the cost of 3 hours.

$$9 \times 3 = 27$$

$$17 + 27 = 44$$

**Answer: 44 dollars**

# Whiteboards · Question 4 of 9

A square floor of side 8 feet is tiled at 3.50 dollars a square foot.

Installation is a flat 60 dollars.

Find the total cost.

**Answer it.**

# Whiteboards · Question 4 of 9

A square floor of side 8 feet is tiled at 3.50 dollars a square foot.

Installation is a flat 60 dollars.

Find the total cost.

Area: $8^2 = 64$

Tile: $64 \times 3.50 = 224$

Total: $224 + 60 = 284$

**Answer: 284 dollars**

# Whiteboards · Question 5 of 9

Evaluate $\frac{1}{2}mv^2$ when $m = 40$ and $v = 3$.

Which is the value?

**A.** 180

**B.** 120

**C.** 360

**D.** 3,600

**Answer it.**

# Whiteboards · Question 5 of 9

Evaluate $\frac{1}{2}mv^2$ when $m = 40$ and $v = 3$.

Which is the value?

$v^2 = 3^2 = 9$

$\frac{1}{2} \times 40 \times 9 = 20 \times 9 = 180$

**Answer: A — 180**

# Whiteboards · Question 6 of 9

A square patio of side 12 feet is sealed at 1.25 dollars a square foot.

Delivery of the sealer is a flat 38 dollars.

Which expression gives the total cost?

**A.** $12(1.25) + 38$

**B.** $12^2 + 1.25 + 38$

**C.** $12^2(1.25 + 38)$

**D.** $12^2(1.25) + 38$

**Answer it.**

# Whiteboards · Question 6 of 9

A square patio of side 12 feet is sealed at 1.25 dollars a square foot.

Delivery of the sealer is a flat 38 dollars.

Which expression gives the total cost?

Area $12^2$ square feet, at 1.25 dollars each: $12^2 \times 1.25$

The 38 dollars is added once: $12^2 \times 1.25 + 38 = 218$

**Answer: D — $12^2(1.25) + 38$**

# Whiteboards · Question 7 of 9

A square garden has 4 sides, each $\sqrt{150}$ feet long.

Find its perimeter, to the nearest hundredth of a foot.

**Answer it.**

# Whiteboards · Question 7 of 9

A square garden has 4 sides, each $\sqrt{150}$ feet long.

Find its perimeter, to the nearest hundredth of a foot.

$$\sqrt{150} \approx 12.2474$$

$$4 \times 12.2474 \approx 48.99$$

**Answer: 48.99 feet**

# Whiteboards · Question 8 of 9

Evaluate $\frac{a^2 - b}{c}$ when $a = 7$, $b = 4$, $c = 5$.

**Answer it.**

# Whiteboards · Question 8 of 9

Evaluate $\frac{a^2 - b}{c}$ when $a = 7$, $b = 4$, $c = 5$.

Top: $7^2 - 4 = 49 - 4 = 45$

$45 \div 5 = 9$

**Answer: 9**

# Whiteboards · Question 9 of 9

One pizza order costs 13 dollars plus 2 dollars for each of 5 toppings.

Another costs 13 dollars for each of 2 pizzas, plus 5 dollars for delivery.

Find both totals, and say why the key words could not have told you.

**Write your answer in sentences.**

# Whiteboards · Question 9 of 9

One pizza order costs 13 dollars plus 2 dollars for each of 5 toppings.

Another costs 13 dollars for each of 2 pizzas, plus 5 dollars for delivery.

Find both totals, and say why the key words could not have told you.

First order: $13 + 2 \times 5 = 13 + 10 = 23$

Second order: $13 \times 2 + 5 = 26 + 5 = 31$

Both say "plus" and "for each". What repeats is different.

**Answer: 23 dollars and 31 dollars**

# Independent Set

1. $6x^2$ when $x = -2$
2. $\frac{1}{2}mv^2$ when $m = 90$ and $v = 4$
3. $\frac{a^2 - b}{c}$ when $a = 9,\ b = 6,\ c = 5$
4. A square room of side 10 feet is carpeted at 2.65 dollars a square foot, with a flat 55 dollars for fitting. Find the total cost.
5. $2(x + y)^2 - 3$ when $x = 4$ and $y = 1$
6. A gym charges 25 dollars to join plus 8 dollars for each of 6 classes. Find the total cost.

# IXL

1. Open IXL and start today's skills.
2. Work on paper where the question needs work. The answer box does not show it.
3. Every skill listed is required, to a SmartScore of 67. Due by the unit test.

**Today's skills — all required**

Evaluate variable expressions: word problems — DPG