

Honors Algebra 1 Notes...

Date: KEY

1.1 Evaluate Expressions *Goal • Evaluate algebraic expressions and use exponents.*

VOCABULARY

Variable IS A LETTER (X, Y, A, B, ...) THAT REPRESENTS A NUMBER

Terms ARE SEPERATED BY ADDITION AND SUBTRACTION SIGNS

EXAMPLE (3 terms): (a) $X^2 + 2X + 10$ (b) $2X - 4Y - 6$

Algebraic expression (an algebraic expression is also called a variable expression)

EXPRESSION IS A COLLECTION OF NUMBERS, VARIABLES, OPERATIONS (+, -, x, ÷) AND SYMBOLS OF INCLUSION. EXPRESSIONS DO NOT HAVE = SIGNS

EXAMPLE: $2X + 3(X - 4)$

Evaluating an expression TO FIND THE VALUE OF THE EXPRESSION

To evaluate an expression, substitute a number for the variable, perform the operation(s), and simplify.

EXAMPLE 1:

a) Evaluate $10 + 5(6 - 2) = 10 + 5(4) = 10 + 20 = 30$

b) Evaluate when $x = 5$... $10X + 15 - X$ *Write the problem*

$10(5) + 15 - (5)$ *Show substitution. Use ()'s !!!!*
 $50 + 15 - 5 = 60$ *Simplify and circle answer*

Expressions with exponents

Base what factor that is repeated

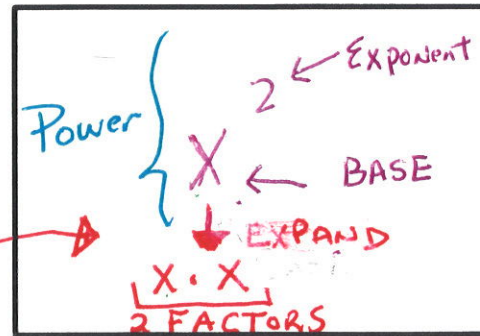
Exponent the number of times it is repeated

Power includes the base + exponent

Factors FACTORS ARE SEPERATED BY MULT SIGNS.

EX → $-2xy$ has 3 factors $-2, x, y$

➤ Expand Powers to a product of Factors



EXAMPLE 2: Write in words, expand to a product of factors, and evaluate.

Power	Words	Expand to a product of factors	Evaluate
a. 12^1	<u>12 to the first</u>	<u>12</u>	<u>NOTE $12 \leftrightarrow 12^1$</u>
b. 12^2	<u>12 SQUARED</u>	<u>$12 \cdot 12$</u>	<u>144</u>
c. $(\frac{1}{2})^3$	<u>$\frac{1}{2}$ CUBED</u>	<u>$\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2}$</u>	<u>$\frac{1}{8}$</u>

EXAMPLE 3:

a) Evaluate when $X = -2$... X^4 *Write the problem*

$(-2)^4$ *3 expand* $-2 \cdot -2 \cdot -2 \cdot -2$ *Show substitution. Use ()'s !!!!*
 $+16$ *Simplify and circle answer*

b) Evaluate when $X = -5$... X^3 *Write the problem*

$(-5)^3$ *3 expand* $-5 \cdot -5 \cdot -5$ *Show substitution. Use ()'s !!!!*
 -125 *Simplify and circle answer*

Mentally expand. Do NOT need to show this step.

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1.2 Apply Order of Operations Goal • Use the order of operations to evaluate expressions.

VOCABULARY.... ORDER OF OPERATIONS To evaluate an expression involving more than one operation, use the following steps.

- Step 1 Evaluate expressions inside ()'s "INSIDE" → "outside"
- Step 2 Evaluate Powers (exponents and square roots).
- Step 3 MULTIPLY and DIVIDE from LEFT to RIGHT.
- Step 4 ADD and SUBTRACT from LEFT to RIGHT.

Example 1 Evaluate expressions with grouping symbols

Grouping symbols such as parentheses (), brackets [] and set notation { } indicate that operations inside the grouping symbols should be performed first

$3[5 + \{(-5)^2 + 5\}]$ $= 3[5 + \{25 + 5\}]$ $= 3[5 + 30]$ $= 3[35]$ 105	<p>Show work going DOWN not across</p> <p>Evaluate powers within parentheses.</p> <p>Evaluate within set notation.</p> <p>Evaluate within brackets.</p> <p>Simplify and circle the final answer</p>
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Example 2 Evaluate fractions

A fraction bar can act as a grouping symbol. Evaluate the numerator and denominator before dividing.

a) Evaluate when X = -2

$\frac{8X}{3(X^2 + 4)}$ $= \frac{8(-2)}{3((-2)^2 + 4)}$ $= \frac{-16}{24}$ $\text{-}\frac{2}{3}$	<p>Show work going DOWN not across</p> <p>Make substitution. Remember ()'s!!!</p> <p>Simplify the numerator</p> <p>Simplify the denominator</p> <p>Simplify the fraction.</p> <p>For fractions, leave as an improper reduced fraction. Do not convert to decimal.</p> <p>Circle the final answer</p>
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NOTE : $-\frac{2}{3} = \frac{-2}{3} = \frac{2}{-3}$

Honors Algebra 1 Notes...

1.4 Write Equations and Inequalities Goal • Solve and determine solutions to equations & inequalities.

VOCABULARY

Symbol	Complete the definition	Example(s)
$a = b$	a is EQUAL to b	$5 = 5$
$a \neq b$	a is NOT EQUAL to b	$-2 \neq 2$
$a < b$	a is LESS than b	$0 < 5$ $-10 < -5$
$a \leq b$	a is LESS than or EQUAL to b	$-5 \leq -5$ $0 \leq +5$
$a > b$	a is GREATER than b	$5 > 0$ $-10 < -5$
$a \geq b$	a is GREATER than or EQUAL to b	$-5 \geq -5$ $0 \geq -5$

Equation **2 EXPRESSIONS CONNECTED WITH AN = SIGN**
TYPICALLY ONLY 1 SOLUTION

Inequality **2 EXPRESSIONS CONNECTED WITH INEQ. SYMBOLS (<, ≤, >, ≥)**
THERE ARE AN INFINITE (∞) NUMBER OF SOLUTIONS

Solution of an equation "OR" an inequality **SOLUTION IS THE NUMBER(S)**
THAT MAKE THE EQUATION OR INEQUALITY TRUE.

Solve **MEANS TO FIND THE VALUE(S)**
THAT MAKE THE VARIABLE TRUE.

IMPORTANT DEFINITIONS !!!!!!! **KNOW THESE DEFINITIONS !!!!!!!**

- Evaluate **EXPRESSION!**
- Solve **EQUATIONS!**

EXAMPLE 1: Check whether $x = -2$ is a solution of the equation or inequality.

<u>Equation or Inequality</u>	<u>Show Work</u>	<u>Conclusion</u>
a. $5x - 8 = 9x$	<p>→ 1) Show Substitution</p> <p>→ 2) Evaluate both sides</p> $5(-2) - 8 = 9(-2)$ <hr style="width: 50%; margin: auto;"/> $-18 \stackrel{?}{=} -18 \checkmark$	-2 IS a solution.
b. $4 + 5x < -8$	$4 + 5(-2) < -8$ <hr style="width: 50%; margin: auto;"/> $-6 < -8 \text{ False}$	-2 IS NOT a solution.
c. $6x + 10 \geq x$	$6(-2) + 10 \geq -2$ <hr style="width: 50%; margin: auto;"/> $-2 \stackrel{?}{\geq} -2 \text{ TRUE}$	-2 IS a solution.

Honors Algebra 1 Notes...

1.5 Use a Problem Solving Plan Goal • Use a problem solving plan to solve problems.

FORMULAS TO KNOW

- 1) **Distance traveled** $d = rt$, where $d =$ DISTANCE, $r =$ RATE, and $t =$ TIME
- 2) **Perimeter** The perimeter of a triangle, square, rectangle or other polygons is the total distance around the edge of the figure.
- 3) **Area of a square** $A = s^2$, where $s =$ SIDE sq units
- 4) **Area of a rectangle** $A = lw$, where $l =$ LENGTH, $w =$ WIDTH sq units
- 5) **Area of a triangle** $A = \frac{1}{2}bh$, where $b =$ BASE, $h =$ HEIGHT sq units

A PROBLEM SOLVING PLAN Use the following strategy to solve a problem.

- Step 1 **Read the problem at least 3 times** to make sure you understand what you want to know and what you want to find out.
- Step 2 **Key Information** – Read problem and write down the key information.
- Step 3 **Draw a Picture** – Re-read the problem and sketch a picture or diagram.
Simple pictures help you understand the problem.
- Step 4 **Define Variable(s)** – define all variables and always include their units of measure.
- Step 5 **Write Equation(s) or Inequalities**
- Step 6 **Solve**
- Step 7 **Check** – Check mathematically. Also, ask yourself “Does this answer make sense?”
- Step 7 **Final Answer** – Write final answer in a complete sentence and include units of measure.

EXAMPLE 1: You just bought a puppy and want to build a rectangular fence to keep her in your yard. You bought 200ft of fence. Your back yard is 40ft wide. You want to know how far back the fence can go into the back yard.

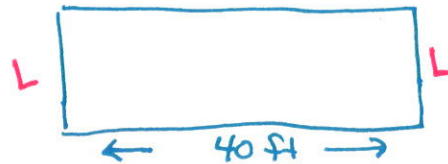
* Word Problem Template (use this format to to solve all word problems assigned)

Key Info (draw picture):

BOUGHT 200 FT FENCE

WIDTH = 40 FT

FIND LENGTH USING
Perimeter formula



Define Variable - remember units:

L = LENGTH (ft)

Define Equation:

$$L + L + 40 + 40 = 200$$

Solve:

$$2L + 80 = 200$$

$$2L = 120$$

$$L = 60$$

Check - Does the solution make sense?

$$60 + 60 + 40 + 40 = 200$$
$$200 = 200 \checkmark$$

Answer (in words) The fence will go back 60 ft.

Honors Algebra 1 Notes...

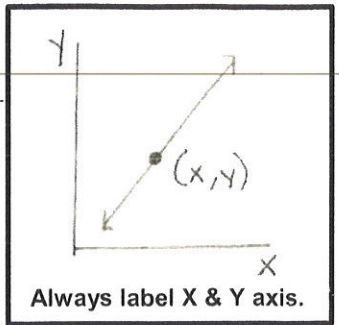
1.6 Understanding Functions

Goal • Represent functions as rules and as tables.

VOCABULARY

Relation IS A SET OF ORDERED PAIRS (X, Y)

➤ EXAMPLE: (0, 3) (3, 2) (1, 2)



Input List of all X values. Do NOT repeat values.

Output List of all Y values. Do NOT repeat values.

Domain List of all X values. Do NOT repeat values.

Range List of all Y values. Do NOT repeat values.

Function IS A SPECIAL RELATION.

YOU IDENTIFY FUNCTIONS 2 WAYS.

➤ Given a table FUNCTIONS CAN NOT HAVE ANY REPEATING X VALUES.

➤ Given a graph FUNCTIONS MUST PASS THE VERTICAL LINE (V-LINE) TEST.

EXAMPLE 1: Identify the domain and range of a function

The input-output table shows temperatures over various increments of time. Identify the domain and range of the function.

Input (hours)	0	1	2	3	4	5
Output (°F)	85	85	85	80	70	60

Domain: X = 0, 1, 2, 3, 4, 5

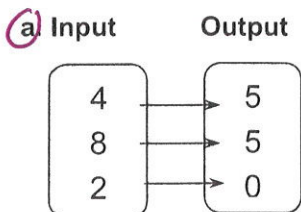
Range: Y = 60, 70, 80, 85

DO NOT REPEAT + PUT IN ORDER L → R

• Why is this a function? BECAUSE THERE ARE NO REPEATING X-VALUES

EXAMPLE 2: Tell whether the pairing is a function and Explain your reasoning. For functions, state the domain and range.

Mapping diagrams are often used to represent functions. TIP: Create x-y table function.



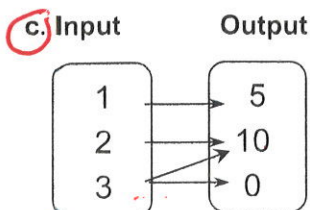
X	Y
4	5
8	5
2	0

a) FUNCTION BECAUSE THERE ARE NO REPEATING X VALUES

b.)

X	Y
2	-2
2	2
3	6
4	8

b) NOT A FUNCTION BECAUSE REPEATING 2's FOR X-VALUES.

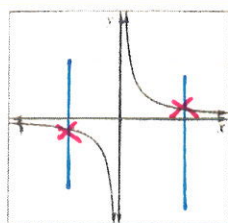
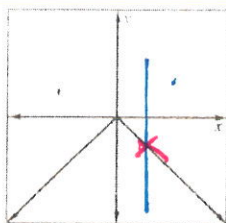
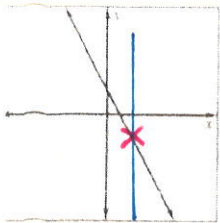


X	Y
1	5
2	10
3	10
3	0

c) NOT A FUNCTION BECAUSE REPEATING 3's FOR X VALUES

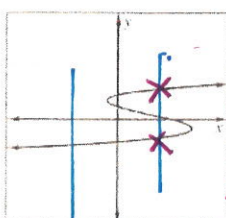
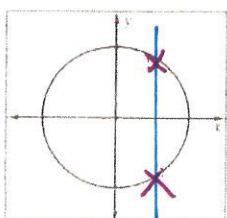
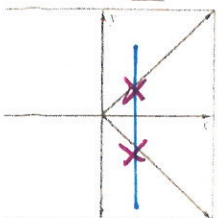
Using the Vertical Line Test to Identify Functions

These are functions. WHY?



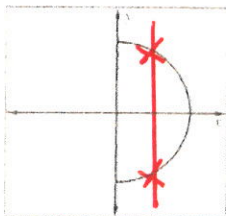
PASS
VLINE
TEST

These are not functions. WHY?

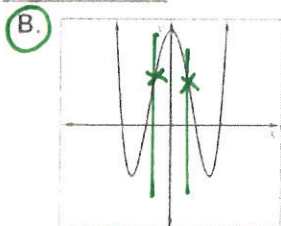


Can draw
at least
1 vline
that touches
graph more
than once

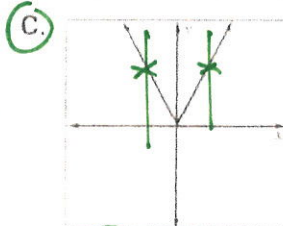
Four of the following are functions. Which are they? Circle the letter.



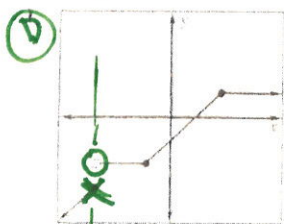
N.F.



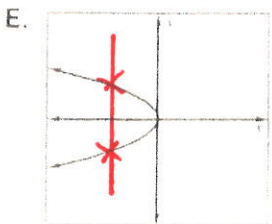
FUNCTION



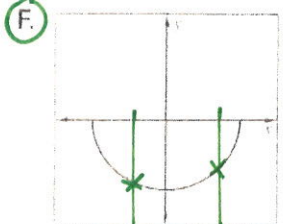
FUNCTION



FUNCTION



N.F.



FUNCTION

YOUR NOTES

① What is a "function"?

"FUNCTION" IS A SPECIAL RELATION WITH NO REPEATING X-VALUES AND PASSES THE VERTICAL LINE TEST

② What is the "vertical line test"?

Abbreviated V-Test.

TO DETERMINE A FUNCTION GIVEN A GRAPH, USE THE V-TEST.

∴ A VERTICAL LINE CAN ONLY TOUCH THE GRAPH IN 1 PLACE TO BE A FUNCTION

Honors Algebra 1 Notes...

MAKE A TABLE FOR A FUNCTION

The domain of the function $y = \frac{1}{2}x - 2$ is 0, 2, 4, and 6.

a. Make a table for the function:

x	0	2	4	6
y	-2	-1	0	1

← Domain are the X values
 ← INPUT X'S INTO $Y = \frac{1}{2}X - 2$

b. What is the range of the function? THE OUTPUTS ARE THE Y-values

→ R: $Y = -2, -1, 0, 1$

FUNCTION RULES

A function may be represented using a rule (in the form of an equation) that relates one variable to another.

Verbal Rule

The output is 2 less than the input.

↑ X

Rule → Equation

$$Y = X - 2$$

↑ Rule is an EQUATION.

Table (fill in w/ the rule)

Input	2	4	6	8	10
Output	0	2	4	6	8

EXAMPLE 3: Write a rule for each function. Identify the domain and the range.

a)

X	Input	3	5	7	9	11
Y	Output	6	10	14	18	22

Steps...

- Let x be the input and let y be the output.
- Look for a pattern. Notice that each output is twice the corresponding input.
- So, a rule for the function is $y = 2x$
- Domain: $x = 3, 5, 7, 9, 11$
- Range: $y = 6, 10, 14, 18, 22$

$$Y = 2X$$

mentally check
 $2(3) = 6$
 $2(5) = 10$

b)

X	Yarn (yd)	1	2	3	4
Y	Total Cost (\$)	1.5	3	4.5	6

- Rule for the function is $Y = X + \frac{1}{2}X$ or $Y = 1.5X$
- Domain: $X = 1, 2, 3, 4$
- Range: $Y = 1.5, 3, 4.5, 6$

Honors Algebra 1 Notes...

1.7 Represent Functions as Graphs

Goal • Represent functions as graphs.

VOCABULARY

- You can use a graph to represent a FUNCTION.
- In a given table, each corresponding pair of input and output values forms an ORDERED PAIR (x,y).
- An ordered pair of numbers can be plotted as a POINT (x,y).
- The x-coordinate is the INPUT (x).
- The y-coordinate is the OUTPUT (y).
- The horizontal axis of the graph is labeled with the X-AXIS.
- The vertical axis is labeled with the Y-AXIS.

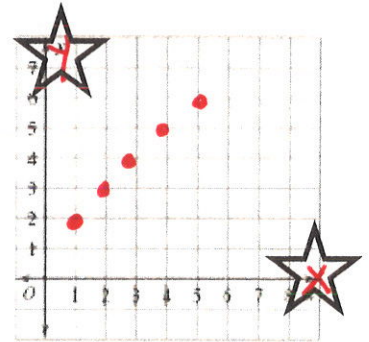
ALWAYS LABEL X+Y!!

Graph a function

Graph the function $y = x + 1$ with domain 1, 2, 3, 4, and 5.

Step 1 Make a table.

x	1	2	3	4	5
y	2	3	4	5	6



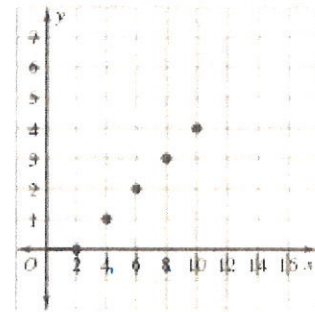
Step 2 Plot the points (x, y).

Step 3 Do not draw the line. Why?

NO! SINCE YOU ARE GIVEN SPECIFIC VALUES IN THE DOMAIN, ONLY PLOT THE SPECIFIC POINTS.

Write a function rule for a graph

Write a function rule for the function represented by the graph. Identify the domain and the range of the function.



Steps...

Step 1 Make a table for the graph.

x	2	4	6	8	10
y	0	1	2	3	4

***Step 2** Look for a pattern between the input and output values

Step 3 Write a rule for the function that describes the relationship.

- A rule for the function is $y = \underline{Y = \frac{1}{2}X - 1}$.
- The domain of the function is $x = \underline{2, 4, 6, 8, 10}$.
- The range is $y = \underline{0, 1, 2, 3, 4}$.

Mentally try patterns

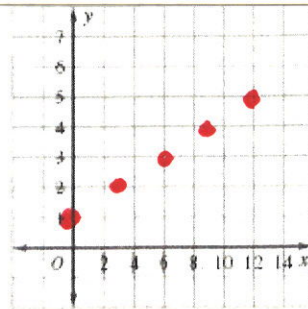
$$\begin{aligned} \frac{1}{2}(2) &= 1 - 1 = 0 \checkmark \\ \frac{1}{2}(4) &= 2 - 1 = 1 \checkmark \\ \frac{1}{2}(6) &= 3 - 1 = 2 \checkmark \\ \frac{1}{2}(8) &= 4 - 1 = 3 \checkmark \\ \frac{1}{2}(10) &= 5 - 1 = 4 \checkmark \end{aligned}$$

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✓ **Checkpoint** Try the following exercises.

1. Graph the function $y = \frac{1}{3}x + 1$ with domain 0, 3, 6, 9, and 12.

X	0	3	6	9	12
Y	1	2	3	4	5

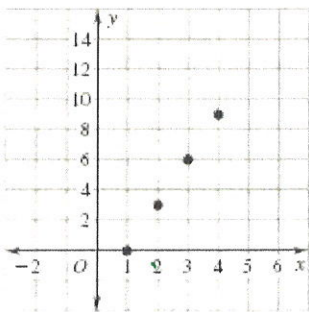


Identify the range:

$y = 1, 2, 3, 4, 5$

Write a rule for the function represented by the graph. Identify the domain and the range of the function.

2.



X	Y
1	0 -1
2	3 +1
3	6 +3
4	9 +5

Domain $x = 1, 2, 3, 4$
Range $y = 0, 3, 6, 9$

Mentally look for pattern

Start w/2

$3(2) - 3 = 3\checkmark$

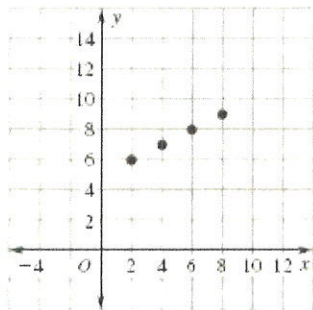
$3(3) - 3 = 6\checkmark$

$4(3) - 3 = 9\checkmark$

$3(1) - 3 = 0\checkmark$

Rule $y = 3x - 3$

3.



X	Y
2	6 +4
4	7 +3
6	8 +2
8	9 +1

Domain: $x = 2, 4, 6, 8$

Range: $y = 6, 7, 8, 9$

Mentally look for pattern

$\frac{1}{2}(2) + 3 = 4 \times$

$\frac{1}{2}(2) + 5 = 6\checkmark$

$\frac{1}{2}(4) + 5 = 7\checkmark$

$\frac{1}{2}(6) + 5 = 8\checkmark$

$\frac{1}{2}(8) + 5 = 9\checkmark$

Rule $y = \frac{1}{2}x + 5$

Lab Worksheet 1-4

TECHNOLOGY ACTIVITY

Editing Expressions and Order of Operations

With the arrow keys on the graphing calculator you can edit expressions quickly and easily, before or after evaluating them.

1. Enter the expression $2 \times 5 + 7 \times 3$ into your calculator. Press **ENTER** or **EXE** to evaluate it.

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Depending on your calculator, you can use the up arrow key, left arrow key, or **ENTRY** key to get the expression back after you evaluate it.

THEN →

2. Which of these keys shows the expression $2 \times 5 + 7 \times 3$ again, on your calculator?

UP ARROW ↑

THEN **ENTER**

3. Move the cursor to the 7 with the arrow keys and press 9. What expression do you see now? Does your calculator replace the 7 with the 9, or does it insert the 9 before the 7?

USE (L) ← (R) →

New EXPRESSION: $2 \cdot 5 + 9 \cdot 3$

THE ARROW KEY REPLACED (NOT INSERTED) 7 WITH 9

If your calculator inserts the 9 and you wish to delete the 7, you can move the cursor to the 7 and press **DEL**. If your calculator replaces the 7 with the 9 and you wish to insert a number before the 9, you can move the cursor to the 9, press **INS**, and then press the number. You can insert and delete operation symbols, such as + and ×, in the same way.

DEL place cursor on what you want to delete

TO INSERT **2ND** **INS**

Evaluate the expression. Use the previous expression and the editing features when convenient.

4. $12 \times 3 + 5 \times 8$ 76

5. $12 \times 13 + 5 \times 7$ 191

6. $2 \times 13 - 5 \times 7$ -9

7. $2 \times 123 - 15 + 5$ 243

The power key on your calculator is marked x^y , a^b , or \wedge . To enter a power, press the base, the power key, and the exponent. For example, press 2, \wedge , and 5 to enter 2^5 . To enter the square of a number you can use the power key or press x^2 after the number.

FOR POWERS use x^2 OR \wedge
TRY $2^5 = 2 \wedge 5 = 32$

Evaluate the expression.

8. $23^3 + 34 + 2$ 12,184

9. $21^2 \times 13 + 10 + 2^3$ 5,734.25

10. $2 + 10^1 - 5 \times 7^2 + 9$ -235.8

11. $2 \times 23^7 - 15 + 5$ 6,809,650,891

OTHER KEYS

(-) Negative
- Subtract

CLEAR CLEAR SCREEN