PRACTICE 11: BASIC MATH

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Math Beyond Numbers

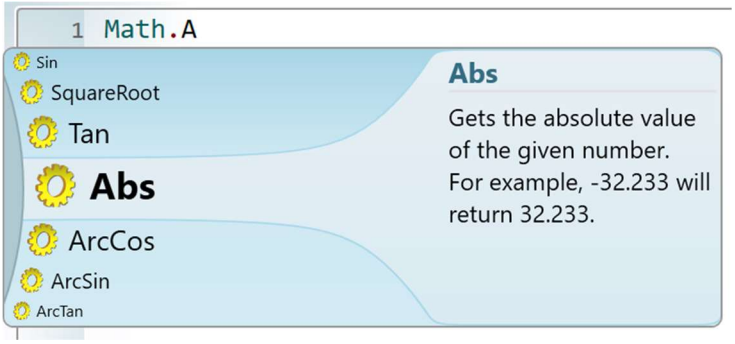
Math is not just about solving equations or building a calculator. We use math in computer science for many things, but also to create art and games, because it helps us describe our environment.

Math Methods

Not only can we do math with our basic addition, subtraction, multiplication, and division, but the Math object in Small Basic has a number of operations built into it that you can use as you design art, games, and yes, even calculators!

Here is a list of just some of the operations: Abs, Ceiling, Floor, GetRandomNumber, Max, Min, Power, Remainder, Round, SquareRoot

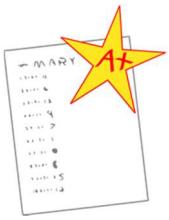
Each operation does something different with the numbers, and the explanations of each can be seen in Small Basic. Below is the description of Math.Abs with an example as well. In Small Basic, you can type 'Math.' in order to view all the different operations, some of which will be covered in a later practice about more complex math.



There are over 20 built in Math methods you can use!

All of these operations allow you to perform different actions with numbers, and can be combined as well. For example, if you wanted to roll a dice, you could use Math.GetRandomNumber(6). The 6 in the parenthesis specifies that we want to get a random number between 1 and 6, since those are the minimum and maximum values on a dice. Another example could be that you are calculating how much money you need to pay a friend, but you only have bills and no coins, so you can't give them anything that isn't a perfect round number. Depending on if you want to just round normally, always round up, or always round down, you could use the Round, Ceiling, and Floor operations to round cents to dollars.

Challenge: Grade Calculator

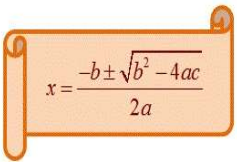


Have you ever wanted to calculate the percentage you need on a final to get your grade in a class and had to use a dozen websites? Try creating your own calculator using Small Basic's various math functions by using your current grade, the final's weight, and your predicted grade. Although this can be completed in a single step, it's best to realize all the necessary variables and functions to be used. Hints are available below.

First, we need to gather input from the user. This number must be a positive, whole number, also known as an integer. For each value (current grade, weight, and grade wanted), we must define the variable right after we give our user instruction.

Then, we use a variety of math operations that Small Basic automatically can read and understand.

Challenge: Quadratic Formula Calculator



Remember using the quadratic formula? This equation is super helpful in finding the zeroes of a graph. For this challenge, try unpacking the formula (on the left) and see which Small Basic Math operations would be helpful.

There are a few steps involved in completing this challenge, and some of them require a little bit of problem solving, so if you need some hints, see below!

The first thing to think about is the discriminant, which is the part of the quadratic equation inside of the square root. If this is negative, the x values will end up being complex numbers, which is something we wouldn't be able to display using Small Basic. We need to utilize what we learned earlier about conditionals to ensure that the rest of the code is only run if the discriminant is positive.

Once it has been established that the discriminant is positive, we can continue with calculating the answer. Since the quadratic equation contains a plus or minus sign, we know that there are going to be two different answers, so we can set up two variables and continue following the

operations of the formula to get the answers. Once this is done, the final step is to print the answers so the user can see them!

Still can't figure these challenges out? See the last two pages for the code and try to understand each line.

Discussion Questions

- What are other apps/websites you use that might need Math operations such as the ones in Small Basic?
- Would you use any Math operations in your classroom? Why or why not?
- Could you think of any operations you use in your math class that we didn't list?
- Why do you think Math operations are built into Small Basic? How is that helpful for us?

Additional Resources

- Small Basic: The Math Object
  - https://aka.ms/sbcurriculum3.3
- Small Basic Tutorial
  - https://aka.ms/sbcurriculum3.3

Grade Calculator Solution:

```
TextWindow.WriteLine("Enter your current grade:
")
current = TextWindow.ReadNumber()
TextWindow.WriteLine("Enter the weight of your final: ")
weight = TextWindow.ReadNumber()
TextWindow.WriteLine("Enter the grade you want in your class: ")
goal = TextWindow.ReadNumber()


value1 = (100-(weight))*(current)/100
TextWindow.WriteLine(value1)
value2 = (goal) - (value1)
TextWindow.WriteLine(value2)
gradeOnFinal = ((value2)/(weight))*100
TextWindow.WriteLine(gradeOnFinal)


TextWindow.WriteLine("You will need a " + gradeOnFinal + " to get an " + goal
+ " in your class.")
```

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Quadratic Formula Calculator

Solution:

```
TextWindow.WriteLine("Enter a")
a = TextWindow.ReadNumber()
TextWindow.WriteLine("Enter b")
b = TextWindow.ReadNumber()
TextWindow.WriteLine("Enter c")
c = TextWindow.ReadNumber()

'The b^2 - 4ac part of the quadratic formula is called the discriminant

discriminant = (Math.Power(b,2)) - (4*a*c)

If discriminant >= 0 Then
    x1 = (-b + Math.SquareRoot(discriminant)) / (2*a)
    x2 = (-b + (-1 * Math.SquareRoot(discriminant))) / (2*a)

    TextWindow.WriteLine("x1 = " + x1)
    TextWindow.WriteLine("x2 = " + x2)
Else
    TextWindow.WriteLine("The x values are not real, sorry")
EndIf
```