

# StatR Math Skills Self-Assessment

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This self-assessment covers some basic topics that will appear during the StatR Certificate. If you cannot answer some of these questions, please brush up on these topics before the program begins. We can help identify resources for practice, if necessary.

You **do not** need to submit your answers to UW Professional and Continuing Education. Still, you must confirm that you are comfortable with the level of math skills in these questions and that you understand that you are expected to know this level of math skills if you are accepted into and start the Certificate.

## Algebra

1. What is the equation of the line in the x-y plane that goes through the points (0, 0) and (2, 2)?
2. What is the slope of the line represented by  $y = 2x + 3$ ?
3. Where does the line represented by  $y = 2x + 3$  intercepts the y-axis?
4. Where does the line represented by  $y = 2x^2 + x$  intercepts the x-axis?
5. Where does the line represented by  $y = x$  intercepts the line represented by  $y = -x$ ?

## Calculus

6. What is the maximum of the function  $y = -2x^2 + 3$ ?
7. What is the minimum of the function  $y = x^2 + 1$ ?
8. What is the derivative of  $y = x^2 + \log(x) + 3$ ?
9. What is the indefinite integral of  $x^2 + 1/x + 3$ ?
10. What is the integral between -1 and 1 of  $x^3$ ?

## Matrix Algebra

$$\text{Let } A = \begin{pmatrix} 1 & 3 \\ 0 & 2 \end{pmatrix}, B = \begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$$

11. What is  $A + B$ ?
12. What is  $A * B$ ?
13. What is A transposed?
14. What is the inverse of A?
15. What is the inverse of B?

## Basic Programming

The reference code and solution are written in R. However, feel free to write your code in any other language of your preference.

1. What is the output of the following code?

```
for (x in c(1, 2, 3, 4)) {  
  y <- x * x  
  if (y %% 2 == 0) print(paste(y, ' is even'))  
}
```
2. What is the output of the following code?

```
sum(c(1, 2, 3, 4) + 2)
```
3. Write a function that, given a list of numbers it calculates their mean?

Thank you for completing this self-test. If you are comfortable with the level of math skills in these questions, and you understand that you are expected to know this information when you start the Certificate, **please add this statement to your admissions letter, "I have completed the Math Skills Self-Test."** If you cannot answer any of these questions or are uncertain of your answers, we recommend completing the following resources:

- Algebra
  - <https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:linear-equations-graphs>
- Calculus:
  - Derivatives: Khan Academy, Differential calculus, especially Power Rule and Chain Rule sections  
<https://www.khanacademy.org/math/differential-calculus/taking-derivatives>
  - Integrals: Khan Academy, Integrals  
<https://www.khanacademy.org/math/integral-calculus/indefinite-definite-integrals>
- Matrix Algebra:
  - Stat Trek, Matrix Algebra Tutorial, complete through the *Matrix inverse* section  
<http://stattrek.com/tutorials/matrix-algebra-tutorial.aspx>
- Programming:
  - A (very) short introduction to R  
<http://cran.r-project.org/doc/contrib/Torfs+Brauer-Short-R-Intro.pdf>

## Answers

### Algebra

- (1)  $y = x$
- (2) 2
- (3) 5
- (4) 0 and -2
- (5) (0,0)

```
{
  my_mean = sum(nums) /
length(nums)
}
print(my_mean(1:5))
```

### Calculus

- (1) 3
- (2) 1
- (3)  $2x + 1/x$
- (4)  $X^3/3 + \log(x) + 3x + c$
- (5) 0

### Matrix Algebra

- (6)  $\begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$
- (7)  $\begin{pmatrix} 7 & 14 \\ 4 & 8 \end{pmatrix}$
- (8)  $\begin{pmatrix} 1 & 0 \\ 3 & 2 \end{pmatrix}$
- (9)  $\frac{1}{2} \begin{pmatrix} 2 & -3 \\ 0 & 1 \end{pmatrix}$
- (10) B is not invertible

### Basic Programming

- (1) 4 is even  
16 is even
- (2) 18
- (3)

```
my_mean = function(nums)
```