

Math requirements

We expect that at the start of the course, you are able to work with fractions, do some basic algebra, sketch a function, and have a basic understanding of derivatives and integrals. More specifically, you should be able to

- Add, subtract, multiply, and divide fractions.
- Solve linear and quadratic equations for an unknown variable
- Sketch the graph of a linear, quadratic, asymptotic, and exponential function
- Understand the relation between a derivative and an integral

We've created a small test consisting of 19 math questions that you can use to test yourself. If you do not master one of the requirements, we recommend that you practice in this area, e.g., via Khan academy. Below you'll find links to background information and practice exercises.

Useful links

Working with fractions: <https://www.khanacademy.org/math/cc-fifth-grade-math/unit-4-7>

Basic algebra:

- <https://www.khanacademy.org/math/algebra-basics/alg-basics-algebraic-expressions>
- <https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:solve-equations-inequalities> (first part up to 'analyzing the number of equations')
- <https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:quadratic-functions-equation-x2f8bb11595b61c86:quadratic-formula-a1/a/quadratic-formula-explained-article>

Derivatives: <https://www.khanacademy.org/math/ap-calculus-ab/ab-differentiation-1-new>

Integrals: <https://tutorial.math.lamar.edu/Classes/CalcI/IntegralsIntro.aspx>

Sketching graphs: <https://tutorial.math.lamar.edu/Classes/Alg/CommonGraphs.aspx>

Self test

Fractions

Solve and simplify

$$1) \frac{3}{4} + \frac{2}{5}$$

$$2) \frac{5}{6} \cdot \frac{2}{7}$$

$$3) \frac{2}{3} \div \frac{2}{5}$$

$$4) \frac{m}{n} \div \frac{a}{b}$$

$$5) \frac{x}{y} \cdot \frac{z}{x}$$

Basic algebra

Solve for x

$$6) 3x + 5 = 20$$

$$7) x^2 + 6x + 9 = 0$$

$$8) 2x^2 + 5x - 3 = 0$$

$$9) ax^2 + bx + c = 0$$

$$10) \frac{2x}{3} + \frac{4}{5} = \frac{7}{15}$$

$$11) \frac{ax}{b} + \frac{c}{d} = \frac{e}{f}$$

Derivatives

$$12) \text{Find the derivative of } f(x) = 3x^2 + 2x + 1$$

$$13) \text{Given } f(x) = x^2, \text{ find the derivative } f'(x), \text{ and then find the integral of } f'(x)$$

$$14) \text{Find the derivative of } e^{2x}$$

$$15) \text{Find the integral of } \frac{1}{x}$$

Sketching functions

Sketch the following functions, clearly indicating the points where the graph intersects the axes and identifying any asymptotes

$$16) \ y(x) = 2x - 3$$

$$17) \ y(x) = -x^2 + 3x - 2$$

$$18) \ y(x) = \frac{2x}{1+x}$$

$$19) \ y(x) = e^x$$

Answers

$$1) \ \frac{3}{4} + \frac{2}{5} = \frac{23}{20}$$

$$2) \ \frac{5}{6} \cdot \frac{2}{7} = \frac{5}{21}$$

$$3) \ \frac{2}{3} \div \frac{2}{5} = \frac{5}{3}$$

$$4) \ \frac{m}{n} \div \frac{a}{b} = \frac{mb}{na}$$

$$5) \ \frac{x}{y} \cdot \frac{z}{x} = \frac{z}{y}$$

$$6) \ x = 5$$

$$7) \ (x+3)(x+3) = 0 \Rightarrow x = -3$$

$$8) \ x = -3 \text{ and } x = \frac{1}{2}$$

$$9) \ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$10) \ x = -\frac{1}{2}$$

$$11) \ x = \frac{b(ed - cf)}{adf}$$

$$12) \ f'(x) = 6x + 2$$

$$13) \ f'(x) = 2x, \text{ the integral of } 2x \text{ is } x^2 + C$$

$$14) \ 2e^{2x}$$

$$15) \ \ln(x) + C$$

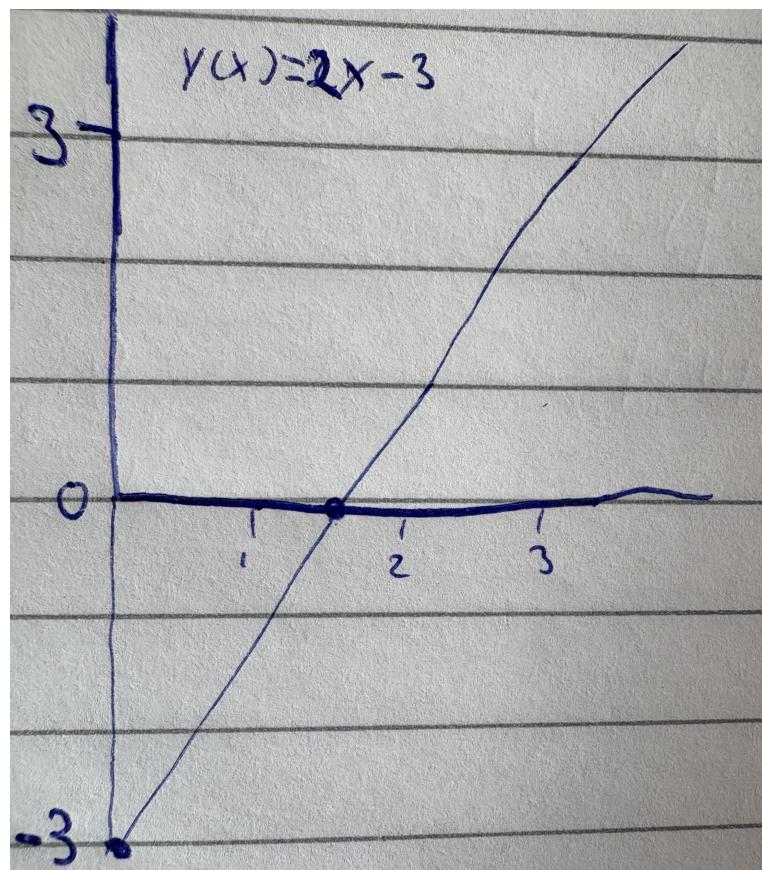


Figure 1: Solution of question 16. A sketch of the function $y(x) = 2x - 3$. The function crosses the y -axis at $y = -3$, and the x -axis at $x = 1.5$.

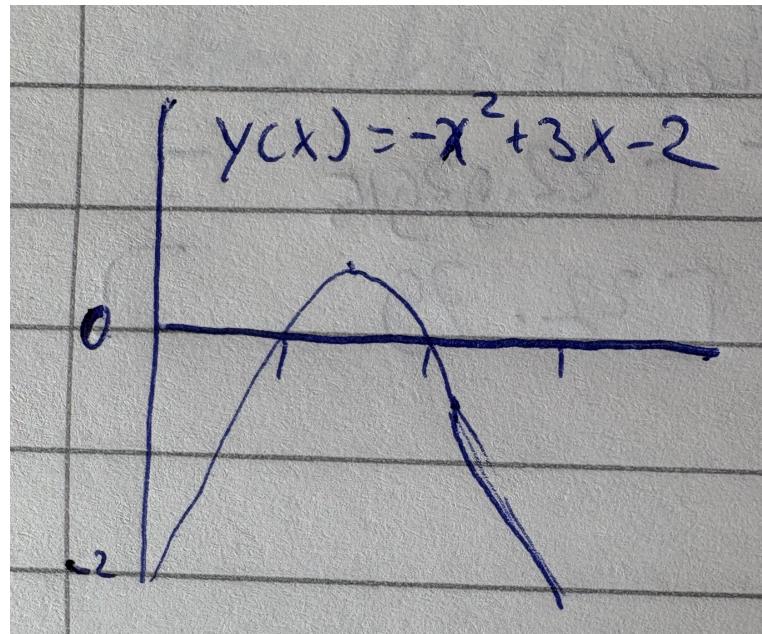


Figure 2: Solution of question 17. A sketch of the function $y(x) = -x^2 + 3x - 2$. The function crosses the y -axis at $y = -2$, and the x -axis at $x = 1$, and $x = 2$. It reaches a maximum at $x = 1.5$

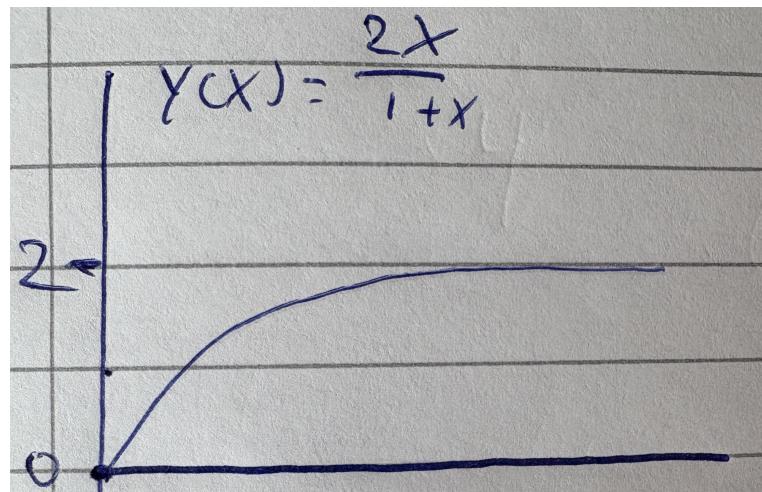


Figure 3: Solution of question 18. A sketch of the function $y(x) = \frac{2x}{1+x}$. The function starts at the origin $(0,0)$ and approaches $y = 2$ when x reaches infinity.

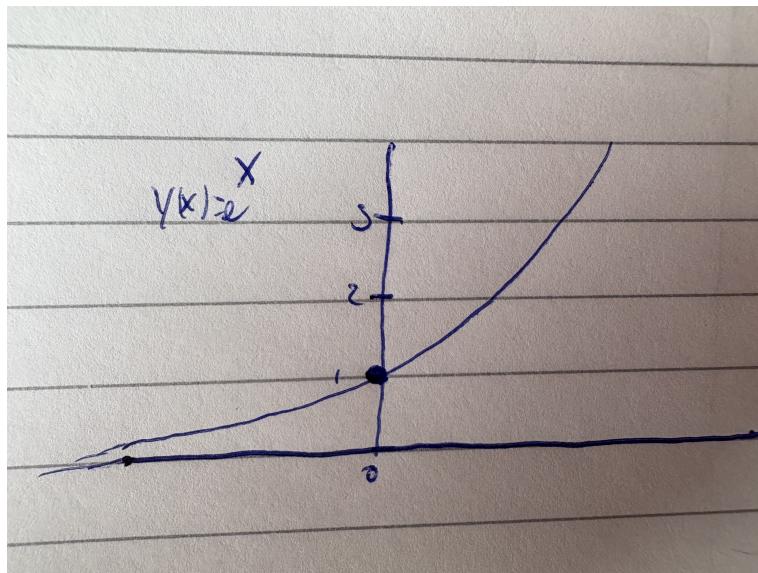


Figure 4: Solution of question 19. A sketch of the function $y(x) = e^x$. The function crosses the y -axis at $y = 1$. As x approaches infinity, $y(x)$ grows exponentially. As x approaches negative infinity, $y(x)$ approaches the horizontal asymptote $x = 0$.