161 Precalculus 1 **Review 1**

Problem 1. Let u and v be linear functions defined as

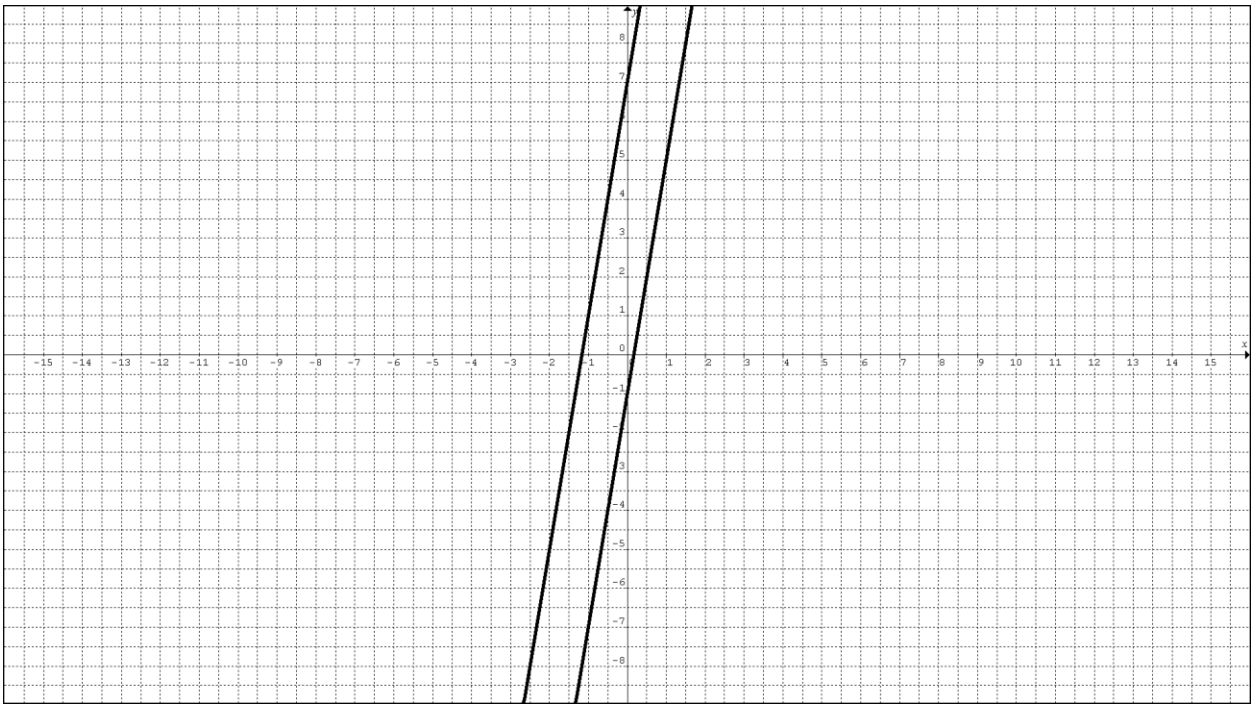
$$u(x) = 2x + 3,$$
$$v(x) = 3x - 2.$$

Find the compositions $u \circ v$ and $v \circ u$. Graph the linear functions $(u \circ v)(x)$ and $(v \circ u)(x)$ in the same coordinate system.

Solution.

$$(u \circ v)(x) = u(v(x)) = 2v(x) + 3 = 2(3x - 2) + 3 = 6x - 1,$$
$$(v \circ u)(x) = v(u(x) = 3u(x) - 2 = 3(2x + 3) - 2 = 6x + 7.$$

The graphs of these two compositions are parallel lines shown below.

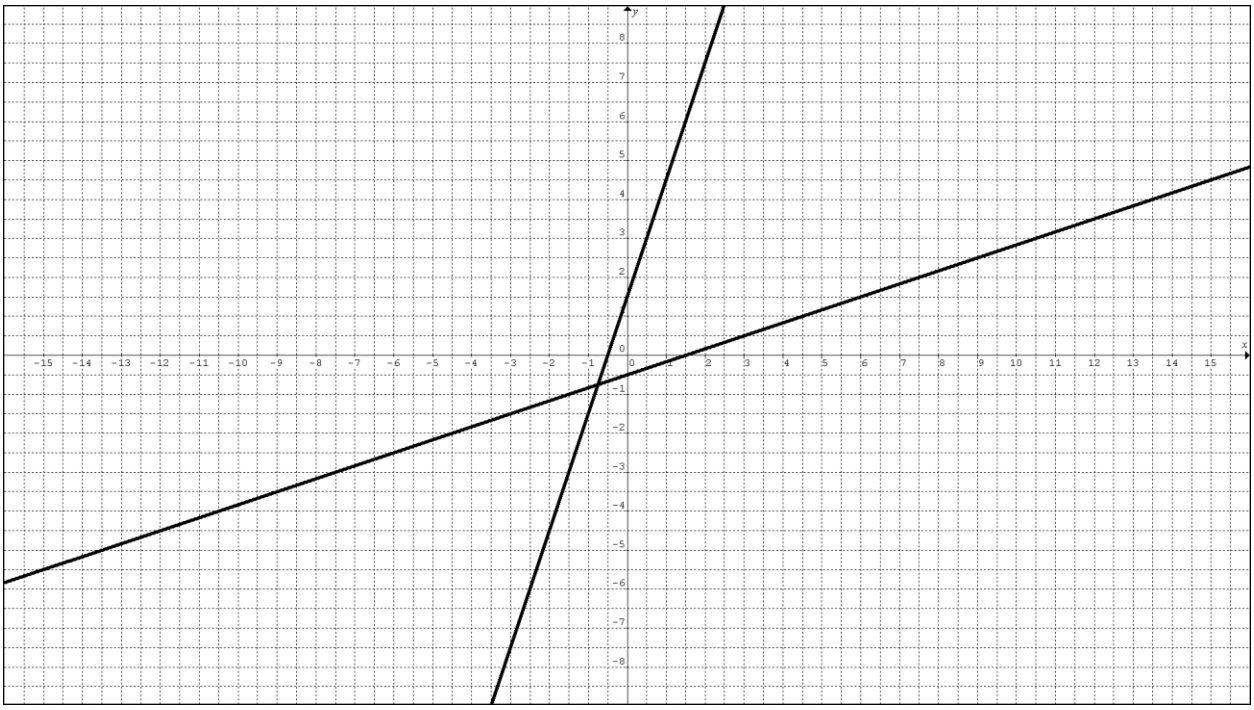


Problem 2. Let $y(x)=\frac{1}{3}x-\frac{1}{2}$**. Find the inverse function** $y^{-1}(x)$ **and graph both functions in the same coordinate system.**

Solution. First we solve the equation $y=\frac{1}{3}x-\frac{1}{2}$ **for** x**. Multiplying both parts of it by 3 we get** $3y=x-\frac{3}{2}$ **whence** $x=3y+\frac{3}{2}$**. Interchanging the input** x **and the output** y **in the last formula we get**

$$y^{-1}(x)=3x+\frac{3}{2}.$$

The graphs of the functions $y(x)$ **and** $y^{-1}(x)$ **are shown below.**



Problem 3. Find an equation of the straight line through the points (-3, 5) and (2, -3) in the slope-intercept form.

Solution.

(a) We will find the slope of the line according to the formula

$$a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-3-5}{2-(-3)} = -\frac{8}{5}.$$

(b) Using one of the given points we will write an equation of the line in the point-slope form. If we use e.g. the second point then such an equation will be written as

$$y - y_2 = a(x - x_2).$$

Or

$$y-(-3) = -\frac{8}{5}(x-2)$$

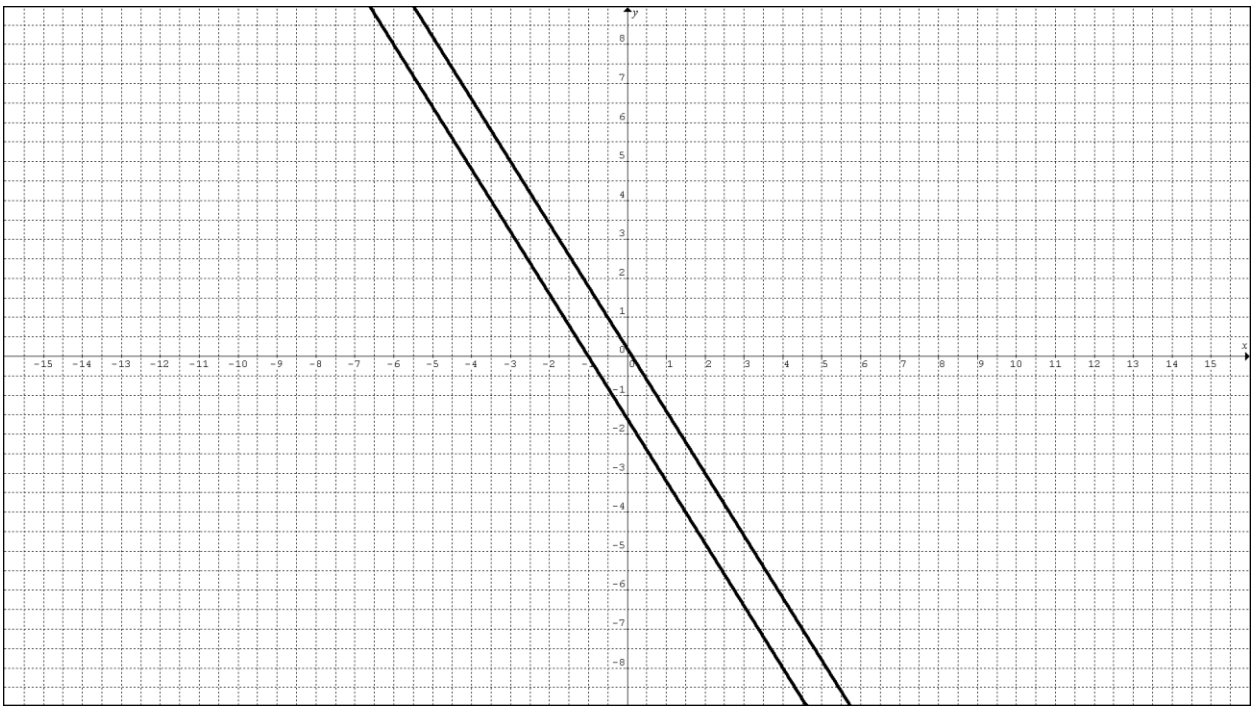
(c)Solving the last equation for y we obtain

$$y = -\frac{8}{5}x + \frac{1}{5}.$$

Problem 4. Find an equation of the line parallel to the line you found in Problem 3 and through the point (-1, 0). Write this equation in the slope-intercept form and graph both lines in the same coordinate system.

Solution. Parallel lines have the same slope whence the slope of the line we are looking for is $-\frac{8}{5}$**. An equation in the point slope form is**

$y-0=-\frac{8}{5}[x-(-1)]$, **or** $y=-\frac{8}{5}x-\frac{8}{5}$**. The graphs are shown below.**



Problem 5. Find an equation of the line perpendicular to the line you found in Problem 3 and through the point (2, -2). Write this equation in the slope-intercept form and graph both lines in the same coordinate system.

Solution. Slopes of perpendicular lines are negative reciprocals whence the slope of the line we are looking for is $\frac{5}{8}$. An equation in the point slope form is

$y-(-2)=\frac{5}{8}(x-2)$, **or** $y=\frac{5}{8}x-\frac{13}{4}$. **The graphs are shown below.**