



201-016-RE  
Algebra and Functions.  
(Fall 2020)

Final Exam, (120 min)  
70 points

**Instructions**

1. **The examination is to be answered in the space provided.**
2. **Write all your solutions in this booklet and show all supporting work.**
3. **You have 2 hours (120 minutes) to complete this examination.**

Best of luck!

**Question 1** (3 points). **Expand** and **simplify** the following algebraic expression.

$$(2x - 5)^2 - (2x - 5) - x(x - 1)$$

\* \* \* \* \*

**Question 2** (3 points). A toaster oven is sold for \$26 in a store that marks up small kitchen appliances by 30%. What was the original price of the toaster oven?

$$\text{(Recall: Selling Price = Cost + Cost} \cdot \text{Markup Rate)}$$

\* \* \* \* \*

**Question 3.** Solve for  $x$  in the following equations.

a) (3 points)

$$3(7 - 2x + x^2) = 14 + 3x^2 - 8(x - 1)$$

b) (3 points)

$$-\frac{x}{8} + \frac{x}{2} + \frac{x}{4} = 1$$

\* \* \* \* \*

**Question 4.** Consider the points  $A = (-4, -2)$  and  $B = (-3, 5)$ .

a) (2 points) Find the equation of the line that passes through  $A$  and  $B$ .

b) (1 point) Find the midpoint between the points  $A = (-4, -2)$  and  $B = (-3, 5)$ .

c) (1 point) Find the distance between the points  $A = (-4, -2)$  and  $B = (-3, 5)$ . Simplify your answer.

\* \* \* \* \*

**Question 5** (3 points). Find an equation of the line that passes through the point  $(-2, -1)$  and is perpendicular to  $6x + 2y = -4$ .

\* \* \* \* \*

**Question 6** (4 points). Solve the following linear system by **the method of elimination**.

$$\begin{cases} 4x + 3y = 4 \\ 2x - 6y = -3 \end{cases}$$

\* \* \* \* \*

**Question 7** (3 points). Simplify the following expression and present the result without negative exponents. You may assume that all variables are positive.

$$\left( \frac{35x^{-5}y^2z^4}{7x^{-3}y^{-3}z^5} \right)^2$$

\* \* \* \* \*

**Question 8** (3 points). Simplify the following expression. You may assume that the letters  $x$ ,  $y$  and  $z$  represent positive numbers.

$$\frac{\sqrt{24x^{10}y^8z^6}}{\sqrt{2x^3y^8}}$$

**Question 9.** Factor each polynomial completely.

a) (3 points)

$$2x^4 - 20x^3 + 42x^2$$

b) (3 points)

$$3x^2 + 11x + 6$$

\* \* \* \* \*

**Question 10** (4 points). Solve the following equation.

$$\sqrt{4 - 12x} - 6 = 2x$$

\* \* \* \* \*

**Question 11** (4 points). Solve for  $x$  by **factoring**.

$$x^3 - 4x^2 - 9x + 36 = 0$$

\* \* \* \* \*

**Question 12** (3 points). By using the **Quadratic Formula**, find all solutions to

$$2x^2 - 3x + 1 = 0$$

\* \* \* \* \*

**Question 13** (2 points). Rationalize the denominator and simplify the result.

$$\frac{\sqrt{3}}{2\sqrt{3} - \sqrt{11}}$$

\* \* \* \* \*

**Question 14** (3 points). Evaluate the following expression.

$$\log_3(81) + \log_5\left(\frac{1}{125}\right) - 2\ln(e^{-10})$$

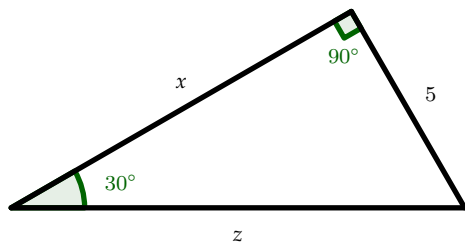
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**Question 15** (3 points). Solve the following equation for  $x$ .

$$4e^{3x} - 5 = 3$$

\* \* \* \* \*

**Question 16** (3 points). Find the exact values of  $x$  and  $z$  in the triangle below. Simplify your answer.



**Question 17** (4 points). Let  $\theta$  be an acute angle in a right angle triangle. If  $\sin(\theta) = \frac{3}{5}$  find the exact values of  $\tan(\theta)$ ,  $\cos(\theta)$  and  $\sec(\theta)$ .

\* \* \* \* \*

**Question 18.** Given  $f(x) = x^2 - 4x - 21$  and  $g(x) = 2|x| - 1$ .

a) (1 point) Evaluate and simplify the following Expression.

$$f(7) + g(-4)$$

b) (2 points) Solve  $f(x) = 0$ .

\* \* \* \* \*

**Question 19.** For the function  $f$ , whose graph is given below, answer the following questions.

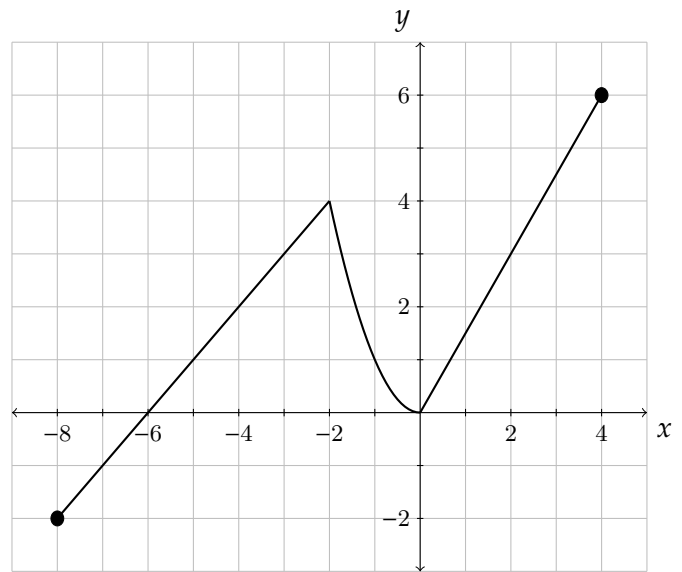
a) (1 point) The domain of  $f(x)$ .

b) (1 point) The range of  $f(x)$ .

c) (1 point) The  $y$ -intercept.

d) (1 point) The  $x$ -intercept(s).

e) (2 points) Evaluate  $|f(-8)| - 2f(4)$ .



## Answers

1.  $3x^2 - 21x + 30$
2. \$20
3. a)  $x = \frac{1}{2}$   
b)  $x = \frac{8}{5}$
4. a)  $y = 7x + 26$   
b)  $(\frac{-7}{2}, \frac{3}{2})$   
c)  $5\sqrt{2}$
5.  $y = \frac{1}{3}x - \frac{1}{3}$
6.  $(\frac{1}{2}, \frac{2}{3})$
7.  $\frac{25y^{10}}{x^4z^2}$
8.  $2x^3z^3\sqrt{3x}$
9. a)  $2x^2(x-3)(x-7)$   
b)  $(3x+2)(x+3)$
10.  $x = -1$
11. We have  $x^3 - 4x^2 - 9x + 36 = (x-4)(x+3)(x-3)$  and so the solutions of  $x^3 - 4x^2 - 9x + 36 = 0$  are  $x = 4$  and  $x = \pm 3$
12. Here  $a = 2$ ,  $b = -3$  and  $c = 1$  and so
$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{3 \pm \sqrt{1}}{4}$$
and so the solutions are  $x = 1$  and  $x = 1/2$ .
13.  $6 + \sqrt{33}$
14. 21
15.  $x = \frac{\ln(2)}{3}$
16.  $z = 10$  and  $x = 5\sqrt{3}$
17.  $\tan(\theta) = 3/4$ ,  $\cos(\theta) = 4/5$  and  $\sec(\theta) = 5/4$ .
18. a) 7  
b)  $x = 7$  and  $x = -3$
19. a)  $[-8, 4]$   
b)  $[-2, 6]$   
c)  $(0, 0)$   
d)  $(-6, 0)$  and  $(0, 0)$   
e) -10