



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.

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

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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?

(Recall: Selling Price = Cost + Cost · Markup Rate)

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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)

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

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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.

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

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

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

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

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

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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)

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

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

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

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

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

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

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

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

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

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

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

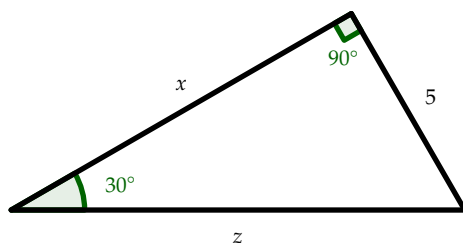
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Question 15 (3 points). Solve the following equation for x .

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

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



Question 17 (4 points). Let θ 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 $\sec(\theta)$.

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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 $f(x) = 0$.

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

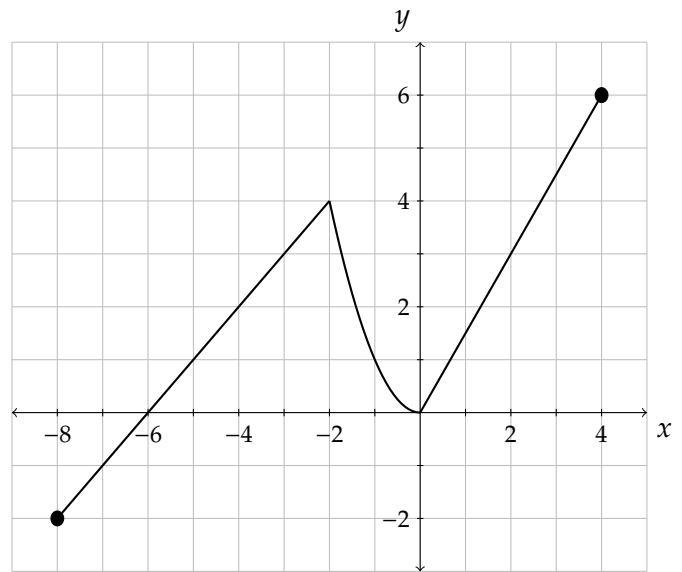
a) (1 point) The domain of $f(x)$.

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

- $3x^2 - 21x + 30$
- \$20
- $x = \frac{1}{2}$
 - $x = \frac{8}{5}$
- $y = 7x + 26$
 - $(\frac{-7}{2}, \frac{3}{2})$
 - $\sqrt{50}$
- $y = \frac{1}{3}x - \frac{1}{3}$
- $(\frac{1}{2}, \frac{2}{3})$
- $\frac{25y^{10}}{x^4z^2}$
- $2x^3z^3\sqrt{3x}$
- $2x^2(x-3)(x-7)$
 - $(3x+2)(x+3)$
- $x = -1$
- 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 $x = \pm 3$
- 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 $x = 1/2$.
- $6 + \sqrt{33}$
- 21
- $x = \frac{\ln(2)}{3}$
- $z = 10$ and $x = 5\sqrt{3}$
- $\tan(\theta) = 3/4$, $\cos(\theta) = 4/5$ and $\sec(\theta) = 5/4$.
- 7
 - $x = 7$ and $x = -3$
- $[-8, 4]$
 - $[-2, 6]$
 - $(0, 0)$
 - $(-6, 0)$ and $(0, 0)$
 - 10