

NC Math 3 Final Exam Review

Observation Vs. Experiment: Determine if each scenario below is an observation or an experiment.

- 1) Fifty people with clinical depression were divided into two groups. Over a 6 month period, one group was given a traditional treatment for depression while the other group was given a new drug. The people were evaluated at the end of the period to determine whether their depression had improved.
- 2) Compare the grades on a final math test of 25 students who use calculators and 25 students who do not use calculators.
- 3) 100 people who regularly work out at a gym and 100 people who do not workout are tested for their cholesterol levels to determine whether exercise helps lower cholesterol.
- 4) A teacher announces a study session to be held the night before a test. The teacher lists the students who attended the session and compares their scores to the students who did not attend the study session.
- 5) To determine whether or not apples really do keep the doctor away, forty patients at a doctor's office were asked to report how often they came to the doctor and the number of apples they had eaten recently.

Sampling Techniques: Suppose you are conducting a survey of benefit packages available in the privately owned businesses in Raleigh. Some sampling techniques are described below, determine the type of sample.

- 1) Assign each business in the Wake County Business Directory a number, then use a random number table to select the businesses to be included in the sample.
- 2) Use postal ZIP codes to divide the county into regions. Pick a sample of 3 ZIP code areas and include all businesses in each selected ZIP code area.
- 3) Using the Wake County Business Directory, number all of the businesses. Selecting a starting place at random, then use every 25th business listed until you have 100 businesses.
- 4) Group businesses into 10 different categories. Select a random sample of 10 businesses from each group.
- 5) Use every business you drive past going down Capital Boulevard.

Types of Bias: Determine the type of bias present in each situation below.

- 1) Students are asked by their teacher whether they had ever cheated on a test.
- 2) A fast food franchiser uses a cluster survey to find out about employer-employee relations.
- 3) A survey asks the question: "Are you in favor of holding the Olympics in Toronto, even though your taxes may increase?"
- 4) A radio station asks listeners to call in to voice their opinions on whether a Canadian figure skater should have won a gold medal.
- 5) A survey is mailed to your house with directions to complete it and mail back, but you throw it in your recycling bin instead.

Solving Systems of Equations: Solve each system using the method of your choice.

$$\begin{aligned} 1) \quad & y=6x-11 \\ & -2x-3y= -7 \end{aligned}$$

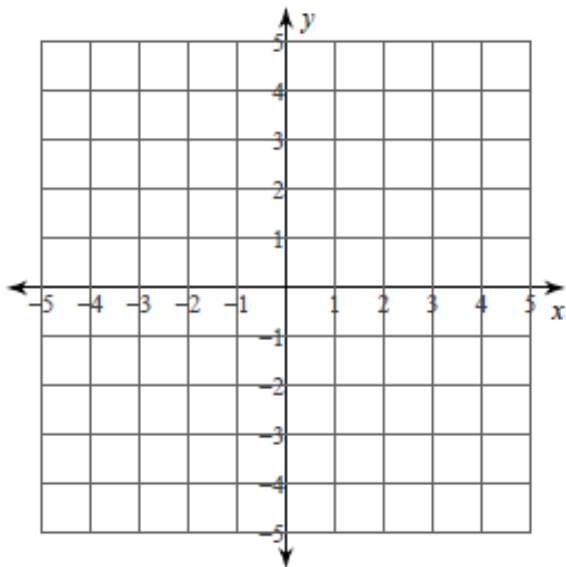
$$\begin{aligned} 2) \quad & -4x+y=6 \\ & -5x-y=21 \end{aligned}$$

$$\begin{aligned} 3) \quad & -5x+y= -3 \\ & 3x-8y=24 \end{aligned}$$

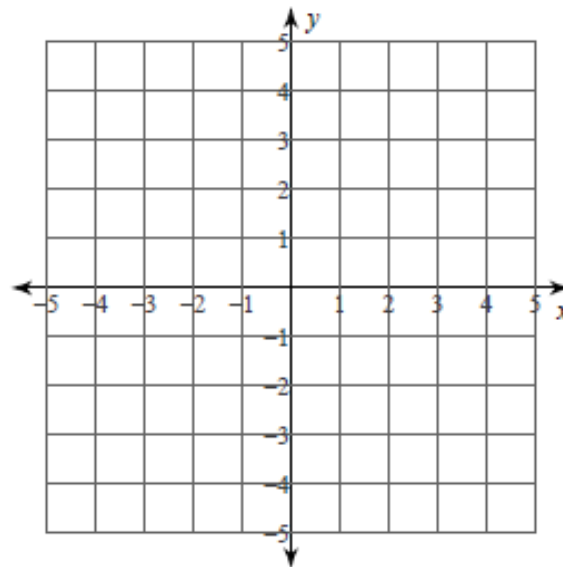
4. The difference of two numbers is 3. Their sum is 13. Find the numbers.
5. The school that Stefan goes to is selling tickets to a choral performance. On the first day of ticket sales the school sold 3 senior citizen tickets and 1 child ticket for a total of \$38. The school took in \$52 on the second day by selling 3 senior citizen tickets and 2 child tickets. Find the price of a senior citizen ticket and the price of a child ticket.
6. Kristin spent \$131 on shirts. Fancy shirts cost \$28 and plain shirts cost \$15. If she bought a total of 7 then how many of each kind did she buy?
7. There are 13 animals in the barn. Some are chickens and some are pigs. There are 40 legs in all. How many of each animal are there?

Solving Systems of Inequalities

8) $3x + y < -3$
 $x + 2y < 4$



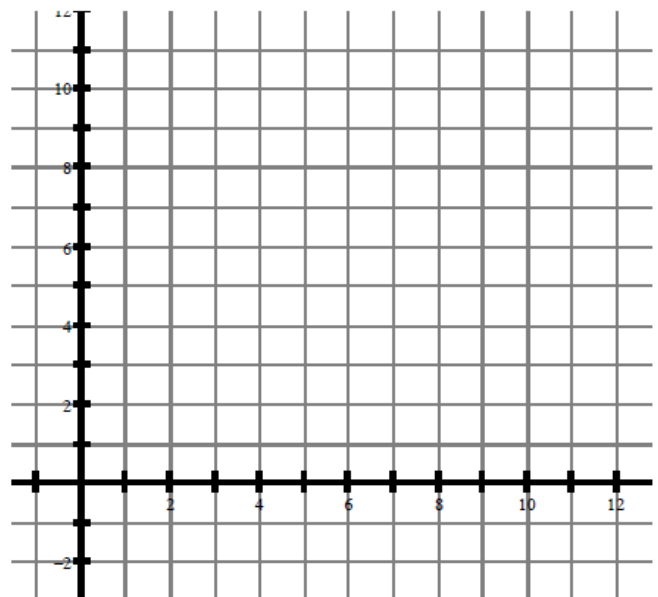
9) $2x - 3y < -9$
 $4x + 3y > -6$



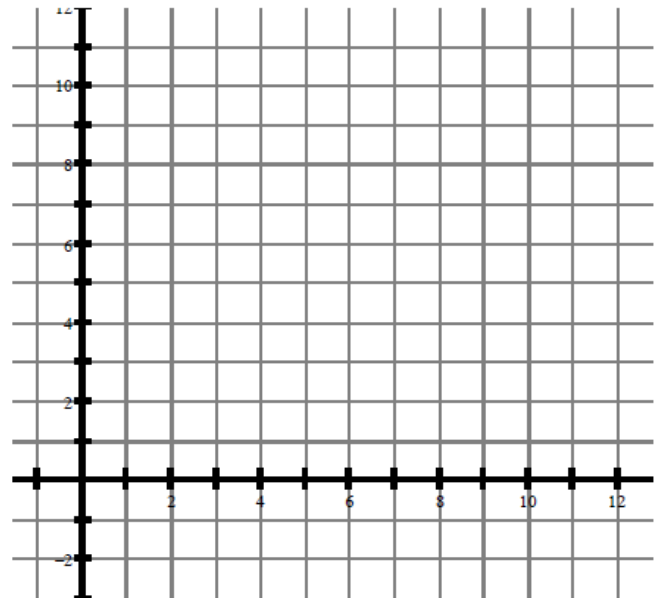
Linear Programming

12) Maximize: $Z = 8x + 2y$

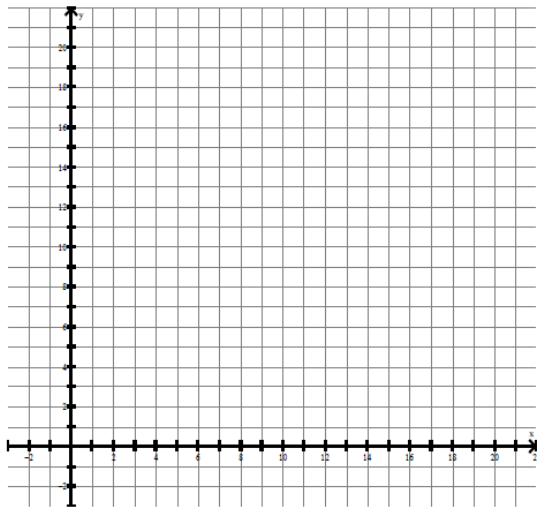
Subject to: $4x + 5y \leq 35$
 $x + 5y \leq 20$
 $y \geq 0$
 $x \geq 0$



13) A patient is restricted to two foods, A and B. Food A contains 2 mg of salt, 80 calories, and 40 mg of protein per unit. Food B contains 1 mg of salt, 90 calories, and 25 mg of protein per unit. The patient is to have no more than 20 mg of salt and 900 calories. How many units of each food should be served in order to maximize protein?



14) Stitches, Inc. can make at most 30 jean jackets and 20 leather jackets in a week. It takes a worker 10 hours to make a jean jacket and 20 hours to make a leather jacket. The total number of hours by the employees can be no more than 500 hours per week. The profit on a jean jacket is \$20, and the profit on a leather jacket is \$50. How many of each jacket should be produced to maximize profit?



Solving Systems of Three Equations Using a Matrix Use your calculator.

$$\begin{aligned} 15) \quad & 4x+4y+z=24 \\ & 2x-4y+z=0 \\ & 5x-4y-5z=12 \end{aligned}$$

$$\begin{aligned} 16) \quad & 3x-3y+4z= -23 \\ & x+2y-3z=25 \\ & 4x-y+z=25 \end{aligned}$$

$$\begin{aligned} 17) \quad & x-2y+z= -6 \\ & x+5z= -12 \\ & -x+6y+4z=3 \end{aligned}$$

Operations with Polynomials

1) $(7n^4 + 6n^3 + 2n) + (8n^4 - n^3 + 5n)$

2) $(p^4 - 8p - 4p^3) - (-7p^4 - 5p^3 + 7p)$

3) $(3k + 7)^2$

4) $(6x + 3)(2x + 5)$

5) $(f + 3)(f^2 + 2f - 6)$

6) $5xy^2(4x^2y + 8xy - 2y)$

Applications of Polynomials

7) The number of dinosaurs in Jurassic World is modeled by $6x^2 + 3x + 130$. The Indominus Rex gets out and kills $2x^2 + x - 54$ dinosaurs before it is stopped. How many dinosaurs are still alive?

8) A rectangular velociraptor paddock has a length of $6x + 2$ feet and width of $3x - 3$ feet.

a. Determine the perimeter of the paddock.

b. Determine the area of the paddock.

9) The lengths of two sides of a triangular stegosaurus feeding trough are given by $5x^2 + 3x - 4$ and $7x + 3$. The perimeter of the feeding trough is $11x^2 + 7x + 3$. Find the length of the missing side.

10) A rectangular tyrannosaurus rex paddock has an area of $x^3 + x^2 - 11x + 4$ square meters, and a width of $x + 4$ meters. Find its length.

Polynomial Division Make sure exponents are in descending order.

11) $(3x^2 + 4x - 12) \div (x + 5)$

12) $(x^2 - 5x - 12) \div (x - 3)$

13) $(x^4 - 3x^2 + 2x + 12) \div (x + 1)$

14) $(2x^3 + 3x^2 - 8x + 3) \div (x + 4)$

Find Vertex

15) $y = x^2 + 16x + 64$

16) $y = 2x^2 - 4x - 2$

17) $y = -3x^2 + 12x - 10$

Simplifying Radicals: Simplify each radical.

18) $\sqrt{-60}$

19) $\sqrt{-300}$

20) $\sqrt{-90}$

Factoring: Factor each polynomial completely.

21) $4x^4 - 16$

22) $6y^2 - y - 12$

23) $21w^3 - 35w$

24) $6n^3 - 8n^2 + 18n - 24$

25) $x^2 - x - 56$

26) $h^3 + 8$

27) $x^3 - 5x^2 - 9x + 45$

28) $27k^3 - 1$

29) $2g^3 - 10g^2 - 72g$

Solving Quadratic Equations: Solve each quadratic equation.

30) $m^2 - 5m - 14 = 0$

31) $2x^2 - 3x - 5 = 0$

32) $2k^2 - 7k - 13 = -10$

33) $8a^2 + 6a = -5$

34) $8n^2 - 18 = 4n$

35) $2h^2 = -4h - 3$

Applications of Quadratics

36) A toy rocket is launched upward from ground level. Its height h after t seconds is given by the equation $h = -16t^2 + 128t$.

- What height is rocket after 3 seconds?
- When will the rocket hit ground?

37) The number of new cars purchased in a city is modeled by the equation $C = 25t^2 + 178t + 3180$, where C is the number of new cars and $t = 0$ corresponds to the number of new cars purchased in 1960.

- How many cars were purchased in 1973?
- In what year will the number of new cars reach 25,000?

38) A company makes and sells swing sets. The equation $P = -0.5x^2 + 176x - 1440$ can be used to model the company's monthly net profit, P , where x is the price the company charges per swing set. What price should the company charge to make the maximum profit?

End Behavior/Zeros of Polynomials: Describe the end behavior of each function below.

39) $f(x) = 3x^4 - 19x^3 + 3x^2 + 91x - 30$

40) $f(x) = 2x^3 - 8x^2 + 8x - 32$

41). $f(x) = -2x^4 + 5x^3 - 7x^2 + 10x - 6$

42) $f(x) = -6x^5 - 25x^4 + 76x^3 + 60x^2$

Classifying Sequences: Identify each sequence as arithmetic, geometric, or neither.

1) 7, 10, 13, ...

2) 1, -2, 4, ...

3) 1, 4, 9, ...

4) $\frac{10}{3}, \frac{7}{3}, \frac{4}{3}, \dots$

5) 2, -6, -18, ...

6) 25, 5, 1, ...

Explicit and Recursive Formulas

Write the explicit and recursive formulas for each sequence.

7) -22, -18, -14, ...

8) $-3, -\frac{3}{2}, -\frac{3}{4}, \dots$

9) 1, 4, 16, ...

10) 9, 3, -3, ...

Find the specified term of each sequence.

11) Find a_7 of the sequence 2, -3, 4.5, ...

12) Find a_{19} of the sequence -1, 3, 7, ...

13) Find a_8 of the sequence 168, 84, 42, ...

14) Find a_{12} of the sequence -3, -5, -7, ...

Sums of Series

15) Find the sum of the first eighteen terms of the series $8 + 11 + 14 + \dots$

16) Find the sum of the series $-6 - 3 - 1.5 - \dots$

17) Find the sum of the first twelve terms of the series $1 + 3 + 9 + \dots$

18) Find the sum of the first ten terms of the series $\frac{1}{3} + \frac{4}{3} + \frac{16}{3} + \dots$

19) Find the sum of the series $5 + 6 + \frac{36}{5} + \dots$

20) Find the sum of the first sixteen terms of the series $4 + 1 - 2 - \dots$

21) Find the sum of the series $18 + 12 + 8 + \dots$

Applications of Sequences and Series

22) The distance, in feet, that a free-falling body falls in each second, starting with the first second, is given by the sequence 16, 48, 80, ... Find the distance that the body falls in the ninth second.

23) In a financial deal, you are given \$700 the first day and each day after that you will receive 65% of the previous day's amount. How much money will you have earned after twelve days?

24) A forty row theater has ten seats in the front row. The second row has twelve seats. If each row has two more than the row in front of it, how many seats are there in the theater?

25) A man swims 1.5 mi on Monday, 1.65 mi on Tuesday, and 1.815 mi on Wednesday. If the pattern continues, how many miles will he swim on Saturday?

26) An embroidery pattern calls for five stitches in the first row and for three more stitches in each successive row. The 25th row, which is the last row, has 77 stitches. Find the total number of stitches in the pattern

Simplifying, Multiplying, and Dividing Rational Expressions: Simplify each rational expression.

$$8) \frac{3y(y+7)}{(y+7)(y^2-9)} \quad 9) \frac{p^2+2p-3}{p^2-2p-15} \quad 10) \frac{x-5}{10x-2} \cdot \frac{25x^2-1}{x^2-10x+25} \quad 11) \frac{2d+6}{d^2+d-2} \div \frac{d+3}{d^2+3d+2}$$

Adding and Subtracting Rational Expressions - Add or subtract each rational expression. Simplify.

$$12) \frac{5a^2}{6b} + \frac{9}{14a^2b^2}$$

$$13) \frac{5x}{x-3} + \frac{2}{x+4}$$

$$14) \frac{x+10}{3x-15} - \frac{3x+15}{6x-30}$$

$$15) \frac{5x}{x^2-x-6} - \frac{4}{x^2+4x+4}$$

Solving Rational Equations Solve each equation. Be sure to check for extraneous solutions.

$$16) \frac{7}{r+2} = \frac{6}{r-5}$$

$$17) \frac{x}{x+2} - \frac{x+2}{x-2} = \frac{x+3}{x-2}$$

$$18) p + \frac{p^2-5}{p^2-1} = \frac{p^2+p+2}{p+1}$$

$$19) \frac{3}{2x} - \frac{5}{3x} = 2$$

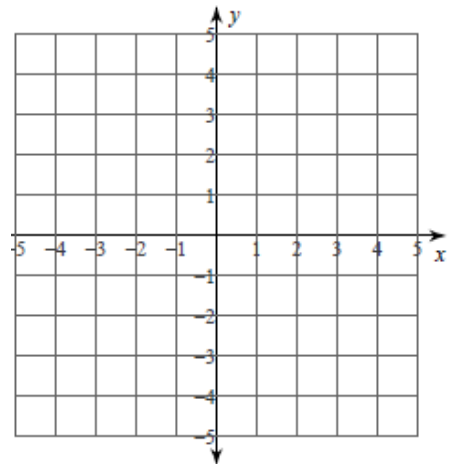
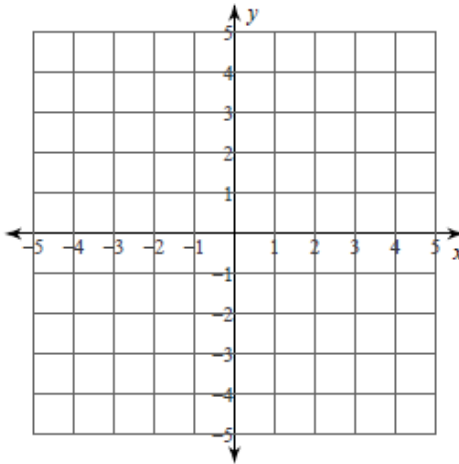
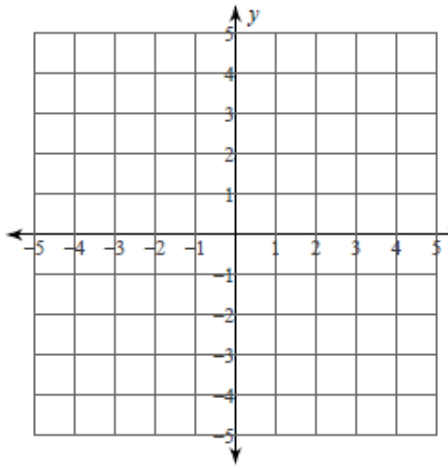
Graphing Rational Functions: Complete the table for each function below. Then graph the function.

$$20) f(x) = \frac{6(x-1)(x+9)(x-8)(x+7)}{(x+9)(x+7)(x-3)}$$

$$21) f(x) = \frac{x^2+2x-15}{x-3}$$

$$22) f(x) = \frac{x-1}{x^2+3x-4}$$

Holes:			
Vertical Asymptotes:			
Horizontal Asymptotes:			
X-Intercepts:			
Y-Intercepts:			
Domain:			



Logarithms and Exponents

I. Write the following in exponential form:

a. $\log_2 8 = x$

b. $\ln x = 2$

c. $\log_3 \frac{1}{27} = -3$

d. $\log_5 a = 10$

II. Write the following in logarithmic form:

a. $y = 3^4$

b. $32 = x^5$

c. $125 = 5^x$

d. $e^x = 3$

III. Solve the following equations:

a. $5^{1-2x} = 7$

b. $2^{\frac{3}{x}} = 5$

c. $e^{5x-2} = 40$

d. $\ln(3x - 2) = 3$

e. $\log_5(x - 2) + \log_5 2 = 1$

f. $1 - 2 \log(x + 1) = -1$

Application with Logarithms and Exponents

- Determine whether the function $y = 2(3.5)^x$ represents exponential growth or decay.
 - Evaluate the function at $f(x) = 4$.
 - Find x when $y = 75$.
- Suppose a population of 15 zombies doubles in size every 6 months. Write a function that models this situation.
 - How many zombies will there be after 2 years?
 - How long will it take for the zombie population to reach 1,000?
- A car that costs \$22,000 decreases in value 6% per year.
 - How much will the car be worth in 4 years?
 - When will the car be worth \$5,000?
- Suppose you invest a total of \$12,000 at an annual interest rate of 9%. Find the balance to the nearest dollar after 5 years if it is compounded:
 - Quarterly
 - Continuously

Inverse Functions

IV. Find the inverses of the following functions:

a. $f(x) = \frac{x-2}{5}$

b. $f(x) = -\frac{1}{4}x + 6$

c. $f(x) = 2\sqrt{x} - 3$

d. $f(x) = 2 \ln(x + 1) - 1$