

NC Final Quiz Bowl

Math 3

Name: _____



Directions: The following questions are sample items similar to those found on the EOC Exam. Answer each to the best of your ability. Show all work on a separate sheet of paper.

1. Multiply: $\sqrt[3]{12x^2} \cdot \sqrt[3]{126x^2}$

- A $6x(\sqrt[3]{7x})$
- B $6x(\sqrt[3]{21x})$
- C $6x^2(\sqrt[3]{42})$
- D $6x^2(\sqrt[3]{63})$

Which expression is equivalent to

2. $\frac{2x+6}{x^2+2x-24} \cdot \frac{x^2+2x-24}{x^2-7x+12}$

- A $\frac{2}{x-4}$
- B $\frac{2(x+3)}{x-3}$
- C $\frac{2(x+3)}{(x-4)(x-3)}$
- D $\frac{2(x+3)}{(x+4)(x-3)}$

3. What are the zeros of the polynomial $p(x) = x^3 - 2x^2 - 23x + 60$?

- A $\{-15, -2, 2\}$
- B $\{-5, 3, 4\}$
- C $\{2, 3, 10\}$
- D $\{1, 2, 30\}$

4. Which expression is equivalent to

$\frac{x+3}{6x-3} + \frac{x^2+2x-3}{2x-1}$

- A $3(x-1)$
- B $\frac{x-1}{3}$
- C $\frac{3}{x-1}$
- D $\frac{1}{3(x-1)}$

5. If $h(x) = 2x$ and $g(x) = 3x^2 + 1$, what is $h(g(x))$?

- A $6x^2 + 1$
- B $6x^2 + 2$
- C $12x^2 + 1$
- D $12x^2 + 2$

6. Which polynomial function has as zeros 3 and $4 + i$?

- A $f(x) = x^3 - 11x^2 + 41x - 51$
- B $f(x) = x^3 - 5x^2 - 7x + 51$
- C $f(x) = x^3 + 5x^2 - 7x - 51$
- D $f(x) = x^3 + 11x^2 + 41x + 51$

7. Which equation is equivalent to $\ln 7 + 3 \ln x = 5 \ln 2$?

- A $\ln 7x^3 = \ln 25$
- B $\ln 7x^3 = \ln 32$
- C $\ln 10x = \ln 10$
- D $\ln 21x = \ln 10$

8. Which equation describes the circle with center $(5, -1)$ and radius 7?

- A $(x-5)^2 + (y+1)^2 = 7$
- B $(x-5)^2 + (y+1)^2 = 49$
- C $(x+5)^2 + (y-1)^2 = 7$
- D $(x+5)^2 + (y-1)^2 = 49$

9. In 1950, a U.S. population model was $y = 151 \cdot (1.013)^{t-1950}$ million people, where t is the year. What did the model predict the U.S. population would be in the year 2000?

- A 247 million
- B 255 million
- C 263 million
- D 288 million

The following list shows the number of people (in millions) in the United States whose only means of getting to work was walking.

10.

Year (x)	Number (y)
1940	7.6
1950	7.0
1960	6.4
1970	5.7
1980	5.4
1990	4.5

If $x = 0$ for the year 1940, which equation is the best-fit linear model for the data?

- A $y = -16.5x + 125$
- B $y = -0.06x + 7.6$
- C $y = 0.06x + 10$
- D $y = 7.6x - 0.06$

11.

Divide:

$(6x^3 - 11x^2 - 47x - 20) \div (2x + 1)$

- A $3x^2 - 7x - 20$
- B $3x^2 + 7x - 20$
- C $3x^2 - 4x - 20$
- D $3x^2 + 4x - 20$

12. Simplify: $\frac{\frac{1}{y} - \frac{1}{x}}{\frac{1}{y} + \frac{1}{x}}$

- A $\frac{x-y}{x+y}$
- B $\frac{x+y}{x-y}$
- C 0
- D -1

13. A company that manufactures jeans estimates that the profit for selling a particular style is given by the equation:

$$P = -250x^3 + 1,505x^2 - 300, \text{ for } 0 < x < 6$$

where P is profit in tens of thousands of dollars and x is the advertising expense in tens of thousands of dollars. What does an x -intercept mean in the context of the problem?

- A the number of times the company spent zero dollars on advertising
B the profit when the company spent zero dollars on advertising
C the advertising expense when the company had the most profit
D the advertising expense when the company's profit was zero dollars

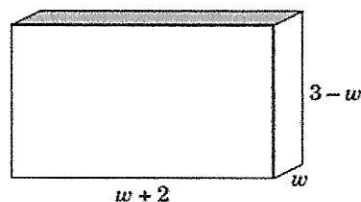
16. Which circle has the smallest area?

- A $x^2 + y^2 = 12$
B $(x-2)^2 + y^2 = 8$
C $(x+1)^2 + (y+3)^2 = 6$
D $(x+8)^2 + (y-9)^2 = 3$

19. In the function $f(x) = a(x-4)^2$, where $a > 0$, what happens to the graph of f as the value of a increases?

- A The graph narrows.
B The graph widens.
C The graph shifts up.
D The graph shifts right.

22. The dimensions of this rectangular prism are given algebraically.



What is the **approximate** width (w) that will maximize the volume?

- A 1 unit
B $1\frac{1}{2}$ units
C $1\frac{3}{4}$ units
D 2 units

14. Copper production increased at a rate of about 4.9% per year between 1988 and 1993. In 1993, copper production was approximately 1.801 billion kilograms. If this trend continued, which equation **best** models the copper production (P), in billions of kilograms, since 1993? (Let $t = 0$ for 1993.)

- A $P = 1.801(4.900)^t$
B $P = 1.801(1.490)^t$
C $P = 1.801(1.049)^t$
D $P = 1.801(0.049)^t$

17. Solve for x : $-\frac{1}{2}|2x+6|+2=0$

- A $x = 5$ or $x = 1$
B $x = 5$
C $x = -5$ or $x = -1$
D $x = -1$

20. In which direction is the graph of $f(x) = \frac{5}{x+b}$ translated when b increases?

- A left
B right
C up
D down

23. A single microscopic organism divides into two organisms every 3 days. Use the formula $N(t) = N_0(2)^{\frac{t}{3}}$, where t is the time in days, $N(t)$ is the number of organisms at t days, and N_0 is the number of organisms at $t = 0$. **Approximately** how long would it take one organism to produce a population of about 10,000 organisms?

- A 1,667 days
B 333 days
C 126 days
D 40 days

15. The profit (P), in dollars, for a company is modeled by the function $P(x) = -750x^2 + 15,000x$, where x is the number of items produced. For which values of x will the company lose money?

- A $x < 2$
B $2 < x \leq 10$
C $10 \leq x < 20$
D $x > 20$

What is the solution set of the system below?

$$\begin{aligned} x &= 2y \\ x - y^2 &= -2y \end{aligned}$$

18. A $\{(0, 0)\}$
B $\{(0, 4)\}$
C $\{(0, 0), (4, 0)\}$
D $\{(0, 0), (8, 4)\}$

21. Which is the inverse of the function $f(x) = x - 9$?

- A $f^{-1}(x) = \frac{1}{x+9}$
B $f^{-1}(x) = x + 9$
C $f^{-1}(x) = 9 - x$
D $f^{-1}(x) = \frac{1}{x-9}$

24. When interest is compounded n times a year, the accumulated amount (A) after t years is given by the formula

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

where P is the initial principal and r is the annual rate of interest. **Approximately** how long will it take \$2,000 to double at an annual interest rate of 5.25% compounded monthly?

- A 13.98 years
B 13.71 years
C 13.23 years
D 13.08 years

25. What are the vertical asymptotes of the function $f(x) = \frac{4x^2 - 100}{2x^2 + x - 15}$?
- A $x = -5, x = 5$
- B $x = -5, x = 4, x = 5$
- C $x = -3, x = \frac{5}{2}$
- D $x = -3, x = \frac{5}{2}, x = \frac{20}{3}$
26. Which is the solution set of the equation $x + 2 = \frac{4}{x-2}$?
- A $\{\pm 2\sqrt{2}\}$
- B $\{2\sqrt{2}\}$
- C $\left\{\frac{-1 \pm \sqrt{17}}{2}\right\}$
- D $\left\{\frac{-1 + \sqrt{17}}{2}\right\}$
27. Which equation represents the graph of $y = x^2$ translated 1 unit right and 2 units down?
- A $y = -(x-1)^2 - 2$
- B $y = (x-1)^2 - 2$
- C $y = -(x+1)^2 + 2$
- D $y = (x+1)^2 - 2$
28. What is the *approximate* value of the greatest zero of $f(x) = x^3 - 6x^2 - x + 3$?
- A -0.75
- B 2.84
- C 6.08
- D 6.31
29. What are the zeros of $f(x) = x^2 + 7x + 5$?
- A $\left\{\frac{7 \pm 2\sqrt{5}}{2}\right\}$
- B $\left\{\frac{-7 \pm 2\sqrt{5}}{2}\right\}$
- C $\left\{\frac{7 \pm \sqrt{29}}{2}\right\}$
- D $\left\{\frac{-7 \pm \sqrt{29}}{2}\right\}$
30. Solve: $3x - 7\sqrt{x} + 2 = 0$
- A $x = \frac{1}{9}, x = 4$
- B $x = \frac{1}{3}, x = 4$
- C $x = \frac{1}{9}, x = -\frac{1}{3}$
- D $x = \frac{1}{3}, x = \frac{1}{9}$
31. Alan has just started a job that pays a salary of \$21,500. At the end of each year of work, he will get a 5% salary increase. What will his salary be after getting his fifth increase?
- A \$22,631
- B \$24,889
- C \$26,133
- D \$27,440
32. Which binomial is a factor of $(x^3 - x^2 + 3x - 3)$?
- A $x - 3$
- B $x + 1$
- C $x^2 - 1$
- D $x^2 + 3$
33. The area of a rectangular window is $(4x^2 - 21x - 18)$. Both the length and the width are polynomials with integer coefficients. Which of the following could represent the length of the window?
- A $4x + 6$
- B $4x + 3$
- C $x + 6$
- D $x + 3$
34. If 5 tractors can plow a field in 4 hours, how many hours will it take 3 tractors to plow the field?
- A $6\frac{2}{3}$
- B $6\frac{1}{2}$
- C $5\frac{2}{3}$
- D $5\frac{1}{2}$
35. The graph of $f(x) = x^2 + 3$ is translated to produce the graph of $g(x) = (x + 2)^2 + 3$. In which direction was the graph of f translated?
- A up
- B down
- C left
- D right
36. Solve for x : $\frac{x-1}{x+5} = \frac{x}{2(x+5)}$
- A -5
- B 2
- C -5 or 2
- D 5 or -2

37. Simplify:

$$\left(x^{\frac{3}{4}}\right)^3$$

A $x^{\frac{27}{64}}$

B $x^{\frac{9}{4}}$

C $x^{\frac{9}{12}}$

D $x^{\frac{15}{4}}$

40. If $f(x) = 2x + 1$ and $g(x) = x^2$, what is $f(g(3))$?

A 343

B 189

C 55

D 34

43. What is an equation of the circle that has center $(-2, 3)$ and passes through $(-1, 1)$?

A $(x + 2)^2 + (y - 3)^2 = 5$

B $(x - 2)^2 + (y + 3)^2 = 5$

C $(x + 2)^2 + (y - 3)^2 = 25$

D $(x - 2)^2 + (y + 3)^2 = 25$

46. Which function is equivalent to $y = x^2 - 6x + 10$?

A $y = (x + 3)^2 - 1$

B $y = (x - 3)^2 + 1$

C $y = (x + 6)^2 - 10$

D $y = (x - 6)^2 + 10$

38. The population of a small town in North Carolina is 4,000, and it has a growth rate of 3% per year. Which expression can be used to calculate the town's population x years from now?

A $3(4,000)^x$

B $4,000(1.03)^x$

C $4,000x^{1.03}$

D $4,000x^3$

41. In which direction does the graph of $y = (x + 2)^{\frac{1}{2}} + c$ shift as c decreases?

A right

B left

C up

D down

44. Which expression is equivalent to $\frac{\cos(\theta)}{1 - \sin(\theta)} - \tan(\theta)$?

A $\sec(\theta)$

B $\sin(\theta)$

C $\cos(\theta)$

D $\csc(\theta)$

47. Where is the vertex of $y = |x + 2|$?

A on the negative x-axis

B on the positive x-axis

C on the negative y-axis

D on the positive y-axis

39. What is the domain of $f(x) = -2x^3 + x^2 + 1$?

A the set of all real numbers

B $\{x | -3 < x < 2\}$

C $\{x | -2 < x < 3\}$

D the empty set

42. Let x and y be real numbers. If $(x + yi) - (2 - 3i) = -6 + 4i$, what are the values of x and y ?

A $x = 8, y = 7$

B $x = 8, y = 1$

C $x = -4, y = 7$

D $x = -4, y = 1$

45. Which is the inverse of $f(x) = 1.5^x + 4$?

A $f^{-1}(x) = \frac{x - 4}{1.5}$

B $f^{-1}(x) = \frac{\log(x) - 4}{1.5}$

C $f^{-1}(x) = \frac{\log(x - 4)}{\log(1.5)}$

D $f^{-1}(x) = \frac{4 - \log(x)}{\log(1.5)}$

48.

What is the domain of $f(x) = \sqrt{-x + 2}$?

A $\{x : x \geq -2\}$

B $\{x : x \leq 2\}$

C $\{x : -2 < x < 2\}$

D $\{x : 0 < x < 2\}$

49. What translations should be applied to the graph of $y = \frac{4}{x}$ to produce the graph of $y = \frac{4}{x-5} + 3$?
- a shift 5 units to the right, and then a shift 3 units down
 - a shift 5 units to the right, and then a shift 3 units up
 - a shift 5 units to the left, and then a shift 3 units up
 - a shift 5 units to the left, and then a shift 3 units down
50. An airplane travels 1,400 miles in the same amount of time it takes a car to travel 210 miles. The car travels at a speed of 340 mph less than the airplane. What is the speed of the airplane?
- 390 mph
 - 400 mph
 - 405 mph
 - 410 mph
51. What are the zeros of $y = \frac{x^2 - 2x - 3}{x^2 + 5x - 14}$?
- 3 and -1
 - 1 and -3
 - 7 and -2
 - 2 and -7
52. Which sentence describes the transformation of the graph of $f(x) = 2x^2$ to the graph of $g(x) = \frac{1}{2}x^2$?
- The graph becomes wider.
 - The graph becomes narrower.
 - The graph shifts down.
 - The graph shifts up.
53. The height, h (in feet), of a ball t seconds after it is thrown upward is given by the equation $h = -16t^2 + 60t + 5$. What does the constant term 5 in the equation represent?
- time required for the ball to hit the ground
 - time required for the ball to reach the highest point
 - height after 5 seconds
 - height when first thrown
54. If $f(x) = \frac{4}{3}x - 9$, what is $f^{-1}(-3)$?
- 13
 - 9.5
 - 7
 - 4.5
55. Simplify: $\frac{4 - \sqrt{3}}{2 - \sqrt{3}}$
- 2
 - $5 + 2\sqrt{3}$
 - $11 - 6\sqrt{3}$
 - $-11 + 6\sqrt{3}$
56. Simplify: $\frac{(3 + 6i)^2}{2i}$
- $\frac{27i}{2}$
 - $9 + 18i$
 - $18 + 27i$
 - $\frac{36 + 27i}{2}$
57. Which equation is equivalent to $3 \log x + \log 2 = \log 3x - \log 2$?
- $\log x^3 + 2 = \log (3x - 2)$
 - $\log (3x + 2) = \log (3x - 2)$
 - $\log 6x = \log \left(\frac{3x}{2}\right)$
 - $\log (2x^3) = \log \left(\frac{3x}{2}\right)$
58. In which direction does the graph of $y = \sqrt{x + a}$ shift as the value of a decreases?
- upward
 - downward
 - to the right
 - to the left
59. The pressure, P , measured in pounds per square inch (psi), on an object under water varies directly with its depth, d , measured in feet. If the pressure on an object at a depth of 20 feet is 8.6 psi, what is the pressure on an object at a depth of 25 feet?
- 6.88 psi
 - 9.85 psi
 - 10.75 psi
 - 13.60 psi
60. What are the vertical asymptotes of $y = \frac{2x^2 - x - 1}{6x^2 - x - 1}$?
- $x = -1, x = \frac{1}{2}$
 - $x = -\frac{1}{2}, x = 1$
 - $x = -\frac{1}{2}, x = \frac{1}{3}$
 - $x = -\frac{1}{3}, x = \frac{1}{2}$