

Secaucus High School

Summer Project

Precalculus

Student Name: _____

Score: _____

1. Which expression is equivalent to

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

A $\frac{2}{x-4}$

B $\frac{2(x+3)}{x-3}$

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

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

2. 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 $\frac{1}{3(x-1)}$

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

4. Which value of x makes this equation true?

$$9(x-7)^{\frac{4}{3}} = 9$$

A 1

B 7

C 8

D 34

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

6. 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 $\{1, 2, 30\}$

7. 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?

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

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 $y = 7.6x - 0.06$

9. What is the inverse of

$$g(x) = \sqrt{5x - 2} + 1, \text{ for all } x \geq \frac{2}{5}?$$

- F $g^{-1}(x) = \frac{(x-1)^2 + 2}{5}$
- G $g^{-1}(x) = \frac{(x-1)^2}{5} + 2$
- H $g^{-1}(x) = \frac{(x+1)^2 - 2}{5}$
- J $g^{-1}(x) = \frac{(x+1)^2}{5} - 2$

10. 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 $(x + 5)^2 + (y - 1)^2 = 49$

11. 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 $x = -1$

12. What are all the roots of $x^3 - 3x^2 - x + 3 = 0$?

A -1 and 1

B 1 and 3

C $-1, 1,$ and 3

D $1, -1,$ and -3

13

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 $P = 1.801(0.049)^t$

14.

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 $3x^2 + 4x - 20$

- 15 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

16. 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 $x = \frac{1}{3}, x = \frac{1}{9}$

- 17 What are the vertical asymptotes of the function $f(x) = \frac{4x^2 - 100}{2x^2 + x - 15}$?

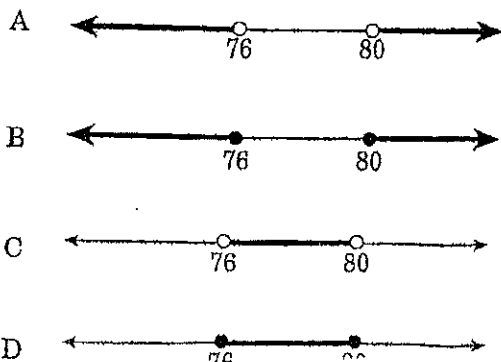
- A $x = -5, x = 5$
- B $x = -5, x = 4, x = 5$
- C $x = -3, x = \frac{5}{2}$
- D $x = -3, x = \frac{5}{2}, x = \frac{20}{3}$

18

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

- 19 A poll shows that it is likely that, with a margin of error of ± 2 percentage points, 78% of those randomly selected from a population would vote for a particular candidate. This situation can be described by the inequality $|x - 78| \leq 2$. Which graph shows the percentage of voters (according to the inequality) who favor the candidate?



20. 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

21. 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 $\ln 21x = \ln 10$

24

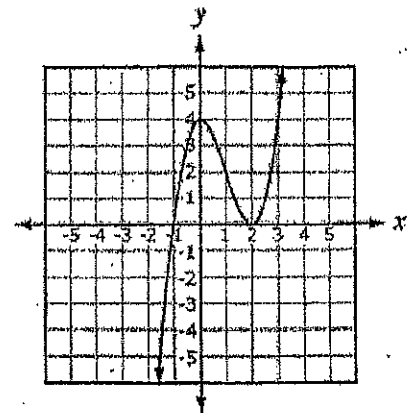
Which set contains all the real numbers that are not part of the domain of

$$f(x) = \frac{x+4}{x^2+4x-32}?$$

- F {8}
 G {-4}
 H {-4, 8}
 J {-8, 4}

22

The graph of a polynomial function $f(x)$ is shown below.



What could be the factorization of the polynomial $f(x)$?

- A. $(x-1)(x+4)(x+2)$
 B. $(x+1)(x-4)(x-2)$
 C. $(x+1)(x-2)(x-2)$
 D. $(x)(x+1)(x-2)$

23. 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 $x=-4, y=1$

25

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

- A 343
 B 189
 C 55
 D 34

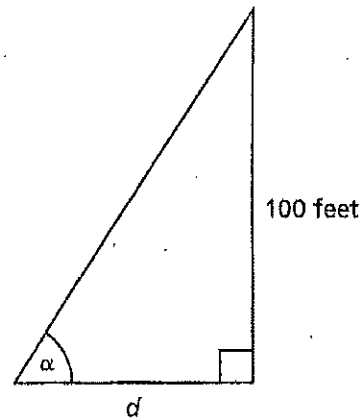
26. A company that manufactures jeans estimates that the profit for selling a particular style is given by the equation:

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

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

27. a height of 100 feet. It is secured to the ground d feet from the base of the tower by a wire that makes angle α with the ground.



Which function can be used to find the distance between the base of the tower and the point at which the wire is attached to the ground?

- F $d = 100 \sin \alpha$
- G $d = 100 \cos \alpha$
- H $d = 100 \cot \alpha$
- J $d = 100 \tan \alpha$

28. Which expression is equivalent to

$$\frac{y^{\frac{1}{2}}}{8x^{\frac{4}{3}}} \div \frac{x^{\frac{1}{3}}y^{\frac{5}{2}}}{6} \text{ for all } x, y \neq 0?$$

F $\frac{1}{2x^{\frac{5}{6}}y^2}$

G $\frac{3}{4x^{\frac{5}{3}}y^2}$

H $\frac{3y^2}{4x^9}$

J $\frac{y^3}{48x^4}$

29. If $f(x) = \sqrt{x^2 - 1}$ and $g(x) = \sqrt{x - 1}$, which expression represents $\frac{f(x)}{g(x)}$, for $x > 1$?

A \sqrt{x}

B $\sqrt{x - 1}$

C $\sqrt{x + 1}$

D $\frac{1}{\sqrt{x + 1}}$

30. The number of cells in a bacteria culture doubles every hour. If there were 500 bacteria cells in a culture at the start of an observation, how many hours will it take to have 50,000 cells in the culture?

- A. 1.70
- B. 2.35
- C. 6.64
- D. 9.97

31. A quadratic function is represented by $f(x) = a(x-h)^2 + k$, where a , h , and k are non-zero real numbers. Which of the following changes will have no effect on the values of the real zeros for a function in this form?

- A. adding 2 to k
- B. adding -1 to h
- C. multiplying a by -1
- D. multiplying the function by 2

32. Consider the functions below.

$$k(x) = \frac{1}{\sqrt{x-6}}$$

$$m(x) = 3x$$

What is the domain of $k(m(x))$ over the set of real numbers?

- A. $x > 0$
- B. $x > 2$
- C. $x > 6$
- D. all real numbers

33. Simplify $\frac{\frac{a-b}{b^2}}{\frac{a^2-b^2}{b}}$.

A. $\frac{1}{ab-b^2}$

B. $\frac{1}{ab+b^2}$

C. $\frac{a^2-2ab+b^2}{b^2}$

D. $\frac{a^3-a^2b-ab^2+b^4}{b^3}$

34. 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 $f(x) = x^3 + 11x^2 + 41x + 51$

35. Given: $5x - 2y + z = 0$
 $2x - y + z = -3$
 $3x + 4y = 18$

What is the value of x in the solution of this system?

36. The roots of a quadratic function are $x = -2 \pm \sqrt{7}$. Find the x -value of the vertex of the corresponding parabola.

A. -4

B. -2

C. -1

D. 0

37. The numbers $i\sqrt{3}$ and $-i\sqrt{3}$ are solutions to which of the following equations?

A. $p^2 + \sqrt{3} = 0$

B. $p^2 + 3 = 0$

C. $p^2 + 9 = 0$

D. $p^2 - 9 = 0$

38. 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

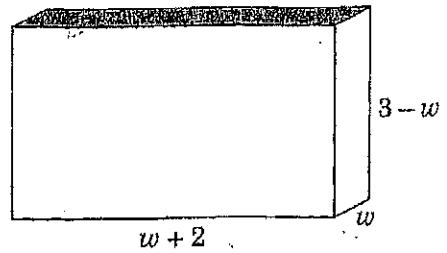
39. How many solutions does the equation $|-1+3x|-5x=9$ have?

A. 0
B. 1
C. 2
D. 3

41. 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

40. 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

Short Answer

The amount of federal income tax a single person with a taxable income of \$77,100 or less must pay is listed below.

- 10% of taxable income up to \$7,825
- 15% of taxable income more than \$7,825 up to \$31,850
- 25% of taxable income more than \$31,850 up to \$77,100

Write a piecewise function to give the total amount of federal income tax a single person owes with a taxable income of x .

Three friends paid the same price per pound for each type of fruit. The number of pounds (lb) of each type of fruit bought and the total price paid by each friend are shown below.

- Rosa bought 2 lb of bananas, 3 lb of peaches, and 1 lb of grapes for \$5.94.
- Zack bought 1 lb of bananas, 2 lb of peaches, and 1 lb of grapes for \$4.56.
- Kim bought 1 lb of bananas and 1 lb of grapes for \$2.78.

What was the price per pound for the bananas, peaches, and grapes they bought?

A cube that measures 4 inches on each side is increased by m inches on each side.

- Part A** Determine the expression for the volume of the new cube in terms of its side.
- Part B** Expand the expression for the volume of the new cube in terms of its side. Show or explain your work.

Extended Response

A cell phone company predicts monthly profit using the equation

$P(x) = -0.6x^2 + 30x + 150$ where $P(x)$ is the monthly profit in thousands of dollars, and x is the amount spent on advertising in thousands of dollars.

- Part A** What amount should the company spend on advertising to maximize the monthly profit? Show or explain your work.
- Part B** Predict the maximum monthly profit. Show or explain your work.
- Part C** To the nearest dollar, what is the maximum amount the company can spend on advertising and still have a positive profit? Show or explain your work.

Extended Response

The average price of a gallon of gasoline in the United States on January 1, 2006, was \$2.238. On January 1, 2007, the average price of a gallon of gasoline was \$2.334.

- Part A** By what percent did the price increase from January 1, 2006, to January 1, 2007?
- Part B** Write a formula giving the price of a gallon of gasoline in terms of the number of years following 2006 if gasoline prices continue to increase exponentially at the annual rate found in Part A.
- Part C** Use your formula to predict the year when the price of a gallon of gasoline in the United States will reach \$10. Show or explain your work.