

## PreAP Precalculus - Summer Assignment

PreAP Precalculus is a rigorous critical thinking course. Our expectation is that each student is fully prepared; therefore, the following Algebra II concepts must be mastered prior to the beginning of PreAP Precalculus.

- *Simplifying complex fractions*
- *Simplifying rational expressions and working with rational and negative exponents*
- *Factoring*
- *Function operations, compositions, and inverses*
- *Solving equations*
  - *Linear*
  - *Quadratic*
  - *Equations with rational exponents*
  - *Basic log and exponential equations*
  - *Rational equations*
- *Writing and graphing equations of lines*
- *Characteristics of graphs*
  - *Intercepts*
  - *Domain and range*
  - *Max and min*
  - *Writing equation from a graph*
- *Vertical and horizontal transformations of functions*
- *Parent functions*

***A test over these concepts will take place during the first week of school. The test will be part calculator, part non-calculator.***

Leave answers in simplified radical form or improper fractions (no decimals).

Bring this completed review packet to the first class meeting (all work must be shown). It will count as a homework grade.

We look forward to meeting you in August!

Regards,

The CISD PreAP Precalculus Team

All problems should be worked without the aid of a calculator unless otherwise specified.

## I. Simplifying Complex Fractions

1. 
$$\frac{1 - \frac{1}{3}}{\frac{1}{2} - \frac{1}{6}}$$

2. 
$$\frac{z - \frac{1}{z}}{1 - \frac{1}{z}}$$

3. 
$$\frac{\frac{1}{x^2} - \frac{1}{y^2}}{\frac{1}{x^2} + \frac{2}{xy} + \frac{1}{y^2}}$$

4. 
$$\frac{a-b}{a^{-1} - b^{-1}}$$

## II. Simplifying Expressions

5. 
$$\frac{s^{-2}t^{-3}}{s^{-1}t^0}$$

6. 
$$x^{m-1} \cdot x \cdot x^m$$

7. 
$$81^{\frac{3}{4}}$$

8. 
$$\left(-32a^{10}\right)^{\frac{3}{5}}$$

9. 
$$\left(9^{\frac{1}{2}} + 16^{\frac{1}{2}}\right)^{-2}$$

10. 
$$a^{\frac{1}{2}} \left(a^{\frac{3}{2}} - 2a^{\frac{1}{2}}\right)$$

11. 
$$(2x^2 + 5x + 3)(6x^2 - 5x + 1)^{-1}$$

12. 
$$\frac{a^4 - c^4}{(a+c)^2(a^2+c^2)}$$

13. 
$$\frac{3-5m-2m^2}{2m^2+7m+3}$$

## III. Factoring. (Don't forget to look for a GCF!)

14. 
$$25x^4 - 4x^2$$

15. 
$$x^2 + 9$$

16. 
$$6x^2 + 15x - 36$$

17. 
$$8mn - 10n + 12m - 15$$

18. 
$$2h^3 + 7h^2k - 15hk^2$$

19. 
$$x^3 - 8$$

## IV. Solving Equations.

20. 
$$\frac{3}{2}(z+5) - \frac{1}{4}(z+24) = 0$$

21. 
$$x^2 + 5x - 24 = 0$$

22. 
$$(x-3)^2 + 9 = 25$$

23. 
$$x^{\frac{4}{3}} = 81$$

24. 
$$\log_5 x = 2$$

25. 
$$5^{2x} = \frac{1}{125}$$

26. 
$$x^3 - 2x^2 - 5x + 6 = 0$$

27. 
$$\frac{2x-1}{(x+2)(x^2+3)} = 0$$

28. 
$$\frac{x}{x+2} - \frac{2}{2x-1} = \frac{1}{5}$$

29. 
$$\sqrt{x} + 1 = 41$$

30. 
$$x + \sqrt{31-9x} = 5$$

31. 
$$|2x-1| = 5$$

## V. Equations of Lines

For 32 – 34, write the equation of the line described. State your answer in the form specified.

32. passes through the  $(-2,3)$  and is perpendicular to the line  $3x + 4y = -7$ ;  
point-slope form
33. slope is undefined and passes through the point  $(4,-5)$
34. x-intercept is 5 and y-intercept is 3; standard form
35. Two values of a linear function  $f(x)$  are  $f(4) = 2$  and  $f(-5) = -1$ . Find the equation of  $f(x)$ .
36. For several mammals, the gestation period, in days, and the average life span, in years, is recorded below:

Animal	Gestation (days)	Average Life Span (years)
Rabbit	31	7
Dog	60	11.4
Squirrel	44	9
Wolf	62	11.6

- a. Using your calculator's regression capabilities to find  $L(G)$ , the linear function of best fit for this data. Write decimal values correct to three decimal places.
- b. Use  $L(G)$  to predict the average life span of a kangaroo with a gestational period of 35 days. Give your answers correct to three decimal places and include units of measure.
- c. What are the units of the L intercept? What is the meaning of the L intercept? Could this situation occur?
- d. What are the units of the slope? What is the meaning of the slope in the context of this problem?
- e. What is the meaning of  $(38, 8)$  in the context of this problem?

## VI. Function Operations, Compositions, and Inverses

For 37 – 44, use  $f(x) = x^3 + 1$ ,  $g(x) = x^2 - 2$ ,  $h(x) = x + 3$

37.  $h(2+a)$                       38.  $h(f(x))$                       39.  $g(x)+h(x)$                       40.  $f(g(2))$

41.  $f(x+h)-f(x)$                       42.  $h^{-1}(x)$                       43.  $f(x)\cdot g(x)$                       44.  $g(h(x))$

45. Given  $f(2) = 1$  and the fact that  $g(x) = -2f(x-1) + 5$  to find  $g(3)$ .

## VII. Finding Domain

State the domain of each function.

46.  $f(x) = \frac{1}{x^2 - 4}$

47.  $f(x) = \frac{x-4}{\sqrt{x+3}}$

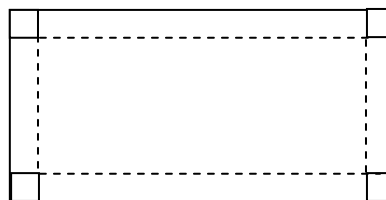
48.  $f(x) = \sqrt{x-6}$

49.  $f(x) = \log(x-3)$

## VIII. Applications of Systems of Equations

50. A 20 m ladder and a 15 m ladder were leaned against a building. The bottom of the longer ladder was 7 m farther from the building than the bottom of the shorter ladder, but both ladders reached the same distance up the building. Find the distance.

51. Four squares, each with sides 4 cm long, are cut from the corners of a rectangular piece of cardboard having area 560 sq cm. The flaps are then bent up to form an open-topped box having volume 960 cu cm. Find the dimensions of the original piece of cardboard.



## IX. Transformations of Functions

Describe the sequence of transformations from the parent to the given function.

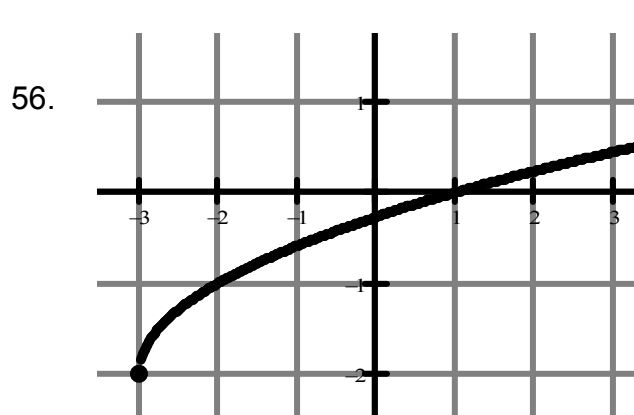
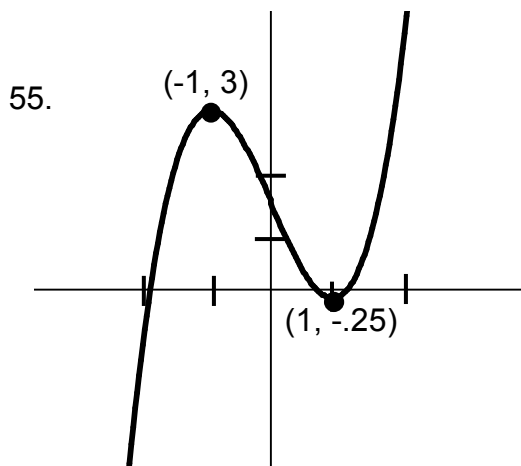
52.  $f(x) = 3(x-1)^2 + 2$

53.  $f(x) = -|x|$

54.  $f(x) = \sqrt{x+4} - 3$

## X. Characteristics of Graphs

For each graph, estimate the x and y intercepts, state the domain, range, and any max or mins.



## XI. Parent Functions

For each parent function, give the equation, sketch the graph, and give the domain and range. List asymptotes where applicable.

57. constant

58. identity

59. quadratic

60. absolute value

61. square root

62. cubic

63. reciprocal

64. exponential

65. logarithmic

## XII. True-False

66.  $9x^{-3} = \frac{1}{9x^3}$

67.  $\frac{x^2 + 3x}{-6} = \frac{-x^2}{6} - \frac{x}{2}$

68.  $5\left(\frac{x^2}{6}\right) = \frac{5x^2}{30}$

69.  $\frac{2x^2 + 3y}{3y} = 2x^2 + 1$

70.  $\sqrt{x+y} = \sqrt{x} + \sqrt{y}$

71.  $\sqrt{x^2 + 9} = x + 3$

72.  $\sqrt{x^2 - 8x + 16} = x - 4$

73.  $\ln e^2 = 2$

74.  $e^{t+s} = (e^t)^s$

## PreAP Precalculus Summer Assignment Key

- |                           |  |   |
|---------------------------|--|---|
| 1. 2                      | 31. 3, -2  | 52. vertical stretch by 3<br>horiz. shift right 1<br>vertical shift up 2  |
| 2. $z + 1$                | 32. $y - 3 = \frac{4}{3}(x + 2)$   |   |
| 3. $\frac{y-x}{y+x}$      | 33. $x = 4$  | 53. vertical reflection<br>over x axis  |
| 4. $-ab$                  | 34. $3x + 5y = 15$   |   |
| 5. $\frac{1}{st^3}$       | 35. $f(x) = \frac{1}{3}x + \frac{2}{3}$  | 54. horizontal shift left 4<br>vertical shift down 3  |
| 6. $x^{2m}$               | 36a. $L(G) = .149G + 2.390$  | 55. x-int: $\approx 0.8, 1.2, -1.9$<br>y-int: $\approx 1.8$<br>domain: $\mathbb{R}$<br>range: $\mathbb{R}$<br>relative max:<br>3 when $x = -1$<br>relative min:<br>$-0.25$ when $x = 1$ |
| 7. 27                     | b. $L(35) = 7.605$ yrs.  |   |
| 8. $-2a^6$                | c. L-intercept is in<br>years. It means<br>that a mammal with<br>a gestational period<br>of 0 has a life span<br>of 2.390 years. |   |
| 9. $\frac{1}{49}$         | d. $m = \text{yrs/day}$ .<br>Average life span<br>increases .149<br>years when<br>gestational period<br>is one day longer.       | 56. x-int: 1<br>y-int: $-0.27$<br>domain: $[-3, \infty)$<br>range: $[-2, \infty)$<br>absolute min:<br>$-2$ when $x = -3$  |
| 10. $a^2 - 2a$            | e. A mammal with<br>gestational period<br>of 38 days is<br>expected to live<br>8 years.  |   |
| 11. $\frac{x+3}{3x-1}$    | 37. $5 + a$  | 66. F   |
| 12. $\frac{a-c}{a+c}$     | 38. $x^3 + 4$  | 67. T   |
| 13. $\frac{-2m+1}{2m+1}$  | 39. $x^2 + x + 1$  | 68. F   |
| 14. $x^2(5x-2)(5x+2)$     | 40. 9  | 69. F   |
| 15. prime                 | 41. $3x^2h + 3xh^2 + h^3$  | 70. F   |
| 16. $3(2x-3)(x+4)$        | 42. $h^{-1}(x) = x - 3$  | 71. F   |
| 17. $(2n+3)(4m-5)$        | 43. $x^5 - 2x^3 + x^2 - 2$   | 72. T   |
| 18. $h(2h-3k)(h+5k)$      | 44. $x^2 + 6x + 7$   | 73. T   |
| 19. $(x-2)(x^2 + 2x + 4)$ | 45. 3  | 74. F   |
| 20. $-\frac{6}{5}$        | 46. $x \neq \pm 2$   |   |
| 21. -8, 3                 | 47. $x > -3$   |   |
| 22. 7, -1                 | 48. $x \geq 6$   |   |
| 23. 27                    | 49. $x > 3$  |   |
| 24. 25                    | 50. 12 cm  |   |
| 25. $-\frac{3}{2}$        | 51. 20 cm x 28 cm  |   |
| 26. -2, 1, 2              |  |   |
| 27. $\frac{1}{2}$         |  |   |
| 28. 3, $-\frac{3}{4}$     |  |   |
| 29. 1600                  |  |   |
| 30. 3, -2                 |  |   |