2023 Standard Pre-Calculus Summer Packet

Greetings 2023 **Standard** Pre-Calculus Students,

To help ensure your success in this Pre-Calculus mathematics course, please complete the **mandatory** Summer work and preliminary preparations by the first day of class, August 7, 2023. There will be a test covering this material.
If you have any questions, please email me at adavis@favikings.org

1st Register in MathXL using the free temporary access code

MathXL for School

1. Registering for MathXL for School
   Before you begin, make sure you have:
   (a) Your school email address
   (b) The Temporary Access Code (one word, do NOT type the dashes)
   HSMXLT-GIGLI-BAUTH-SKEAN-LOBBY-TOTES
   (c) Your **Course ID** is XL0C-61M8-9023-7543

2. To Register, go to www.MathXLforSchool.com and click the Student button under Register.
   Then, follow the instructions on the screen. Create your username & password

   Username: _____

   Password: _____

3. Enrolling in the 2023 PreCalculus course:
   After registering, go to MathXLforSchool.com and log in with your username and password.

   Enter the **Course ID**: XL0C-61M8-9023-7543

   After enrolling in your course, you are ready to start working in MathXL for School

4. For additional help with MathXL for School, refer to these resources
   a. Download a step-by-step visual walkthrough on registering and enrolling: http://www.mathxlforschool.com/support/marketing/student-visual-walkthrough
   b. Get additional help: http://www.mathxlforschool.com/support/marketing/getting-started-students/

Your summer work in MathX is also listed below.

The Sections and Exercise numbers are listed below.

1. Read Chapter **P.1** Real Numbers (on Google Classroom)
   Complete **P.1** Homework (20 Questions): P.1 # 1, 3, 5, 7, 11, 13, 17, 19, 21, 25, 27, 31, 32, 33, 37, 39, 43, 47, 49, 51
   Available Videos: Plotting an inequality example Intro to Rational Exponents, & continue,
2. Read Section **A.1** Radicals & Rational Exponents (on Google Classroom)
   Complete **A.1** Homework (18 Questions): A.1 # 1, 7, 9, 14, 15, 28, 30, 34, 37, 40, 43, 50, 53, 55, 58, 63, 72, 84

A good site for most algebra topics: http://www.purplemath.com/modules/index.htm

Trigonometry: https://www.khanacademy.org/math/trigonometry

Have a Great Summer,

A. Davis, Ph.D.

QUICK REVIEW P.1

1. List the positive integers between -3 and 7.
2. List the integers between -3 and 7.
3. List all negative integers greater than -4.
4. List all positive integers less than 5.

In Exercises 5 and 6, use a calculator to evaluate the expression. Round the value to two decimal places.

5. (a) $4(-3.1)^3 - (-4.2)^5$ (b) $\dfrac{2(-5.5) - 6}{7.4 - 3.8}$
6. (a) $5[3(-1.1)^2 - 4(-0.5)^3]$ (b) $5^{-2} + 2^{-4}$

In Exercises 7 and 8, evaluate the algebraic expression for the given values of the variables.

7. $x^3 - 2x + 1, x = -2, 1.5$
8. $a^2 + ab + b^2, a = -3, b = 2$

In Exercises 9 and 10, list the possible remainders.

9. When the positive integer n is divided by 7
10. When the positive integer n is divided by 13

SECTION P.1 EXERCISES

Exercise numbers with a gray background indicate problems that the authors have designed to be solved *without a calculator*.

In Exercises 1–4, find the decimal form for the rational number. State whether it repeats or terminates.

1. $-37/8$ **2.** $15/99$

3. $-13/6$ **4.** $5/37$

In Exercises 5–10, describe and graph the interval of real numbers.

5. $x \le 2$ **6.** $-2 \le x < 5$

7. $(-\infty, 7)$ **8.** $[-3, 3]$

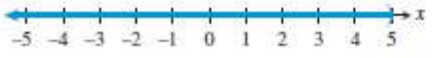
9. x is negative.

10. x is greater than or equal to 2 and less than or equal to 6.

In Exercises 11–16, use an inequality to describe the interval of real numbers.

11. $[-1, 1)$ **12.** $(-\infty, 4]$

13.



14.

15. x is between -1 and 2.

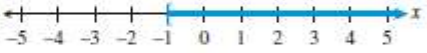
16. x is greater than or equal to 5.

In Exercises 17–22, use interval notation to describe the interval of real numbers.

17. $x > -3$ **18.** $-7 < x < -2$

19.

20.



21. x is greater than -3 and less than or equal to 4.

22. x is positive.

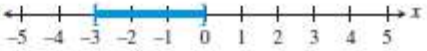
In Exercises 23–28, use words to describe the interval of real numbers.

23. $4 < x \le 9$ **24.** $x \ge -1$

25. $[-3, \infty)$ **26.** $(-5, 7)$

27.

28.



In Exercises 29–32, convert to inequality notation. Find the endpoints and state whether the interval is bounded or unbounded and its type.

29. $(-3, 4]$ **30.** $(-3, -1)$

31. $(-\infty, 5)$ **32.** $[-6, \infty)$

In Exercises 33–36, use both inequality and interval notation to describe the set of numbers. State the meaning of any variables you use.

33. Writing to Learn Bill is at least 29 years old.

34. Writing to Learn No item at Sarah's Variety Store costs more than $2.00.

35. Writing to Learn The price of a gallon of gasoline varies from $1.099 to $1.399.

36. Writing to Learn Salary raises at the State University of California at Chico will average between 2% and 6.5%.

In Exercises 37–40, use the distributive property to write the factored form or the expanded form of the given expression.

37. $a(x^2 + b)$ **38.** $(y - z^3)c$

39. $ax^2 + dx^2$ **40.** $a^3z + a^3w$

In Exercises 41 and 42, find the additive inverse of the number.

41. $6 - \pi$ **42.** -7

In Exercises 43 and 44, identify the base of the exponential expression.

43. -5^2 **44.** $(-2)^7$

45. Group Activity Discuss which algebraic property or properties are illustrated by the equation. Try to reach a consensus.

(a) $(3x)y = 3(xy)$ **(b)** $a^2b = ba^2$

(c) $a^2b + (-a^2b) = 0$ **(d)** $(x + 3)^2 + 0 = (x + 3)^2$

(e) $a(x + y) = ax + ay$

46. Group Activity Discuss which algebraic property or properties are illustrated by the equation. Try to reach a consensus.

(a) $(x + 2)\dfrac{1}{x + 2} = 1$ **(b)** $1 \cdot (x + y) = x + y$

(c) $2(x - y) = 2x - 2y$

(d) $2x + (y - z) = 2x + (y + (-z)) = (2x + y) + (-z) = (2x + y) - z$

(e) $\dfrac{1}{a}(ab) = \left(\dfrac{1}{a}a\right)b = 1 \cdot b = b$

In Exercises 47–52, simplify the expression. Assume that the variables in the denominators are nonzero.

47. $\dfrac{x^4y^3}{x^2y^5}$ **48.** $\dfrac{(3x^2)^2y^4}{3y^2}$

49. $\left(\dfrac{4}{x^2}\right)^2$ **50.** $\left(\dfrac{2}{xy}\right)^{-3}$

51. $\dfrac{(x^{-3}y^2)^{-4}}{(y^6x^{-4})^{-2}}$ **52.** $\left(\dfrac{4a^3b}{a^2b^3}\right)\left(\dfrac{3b^2}{2a^2b^4}\right)$

The data in Table P.1 give the expenditures in millions of dollars for U.S. public schools for the 2005–2006 school year.

Table P.1 U.S. Public Schools

Category	Amount (in millions)
Current expenditures	449,595
Capital outlay	57,375
Interest on school debt	14,347
Total	528,735

Source: National Center for Education Statistics, U.S. Department of Education, as reported in The World Almanac and Book of Facts 2009.

In Exercises 53–56, write the amount of expenditures in dollars obtained from the category in scientific notation.

53. Current expenditures

54. Capital outlay

55. Interest on school debt

56. Total

In Exercises 57 and 58, write the number in scientific notation.

57. The mean distance from Jupiter to the Sun is about 483,900,000 miles.

58. The electric charge, in coulombs, of an electron is about −0.000 000 000 000 000 000 16.

In Exercises 59–62, write the number in decimal form.

59. 3.33×10^{-8} **60.** 6.73×10^{11}

61. The distance that light travels in 1 year (*one light year*) is about 5.87×10^{12} mi.

62. The mass of a neutron is about 1.6747×10^{-24} g.

In Exercises 63 and 64, use scientific notation to simplify.

63. $\dfrac{(1.3 \times 10^{-7})(2.4 \times 10^{8})}{1.3 \times 10^{9}}$ without using a calculator

64. $\dfrac{(3.7 \times 10^{-7})(4.3 \times 10^{6})}{2.5 \times 10^{7}}$

Explorations

65. Investigating Exponents For positive integers m and n, we can use the definition to show that $a^m a^n = a^{m+n}$.

(a) Examine the equation $a^m a^n = a^{m+n}$ for $n = 0$ and explain why it is reasonable to define $a^0 = 1$ for $a \neq 0$.

(b) Examine the equation $a^m a^n = a^{m+n}$ for $n = -m$ and explain why it is reasonable to define $a^{-m} = 1/a^m$ for $a \neq 0$.

APPENDIX A.1 EXERCISES

In Exercises 1–6, find the indicated real roots.

1. Square roots of 81
2. Fourth roots of 81
3. Cube roots of 64
4. Fifth roots of 243
5. Square roots of 16/9
6. Cube roots of $-27/8$

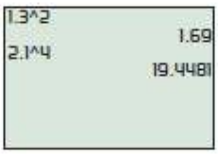
In Exercises 7–12, evaluate the expression without using a calculator.

7. $\sqrt{144}$
8. $\sqrt{-16}$
9. $\sqrt[3]{-216}$
10. $\sqrt[3]{216}$
11. $\sqrt[3]{-\frac{64}{27}}$
12. $\sqrt{\frac{64}{25}}$

In Exercises 13–22, use a calculator to evaluate the expression.

13. $\sqrt[4]{256}$
14. $\sqrt[5]{3125}$
15. $\sqrt[3]{15.625}$
16. $\sqrt{12.25}$
17. $81^{3/2}$
18. $16^{5/4}$
19. $32^{-2/5}$
20. $27^{-4/3}$
21. $\left(-\frac{1}{8}\right)^{-1/3}$
22. $\left(-\frac{125}{64}\right)^{-1/3}$

In Exercises 23–26, use the information from the grapher screens below to evaluate the expression.



23. $\sqrt{1.69}$
24. $\sqrt{19.4481}$
25. $\sqrt[4]{19.4481}$
26. $\sqrt[3]{3.375}$

In Exercises 27–36, simplify by removing factors from the radicand.

27. $\sqrt{288}$
28. $\sqrt[3]{500}$
29. $\sqrt[3]{-250}$
30. $\sqrt[4]{192}$
31. $\sqrt{2x^3y^4}$
32. $\sqrt[3]{-27x^3y^6}$
33. $\sqrt[4]{3x^8y^6}$
34. $\sqrt[3]{8x^6y^4}$
35. $\sqrt[5]{96x^{10}}$
36. $\sqrt{108x^4y^9}$

In Exercises 37–42, rationalize the denominator.

37. $\frac{4}{\sqrt[3]{2}}$
38. $\frac{1}{\sqrt{5}}$
39. $\frac{1}{\sqrt[5]{x^2}}$
40. $\frac{2}{\sqrt[4]{y}}$
41. $\sqrt[3]{\frac{x^2}{y}}$
42. $\sqrt[5]{\frac{a^3}{b^2}}$

In Exercises 43–46, convert to exponential form.

43. $\sqrt[3]{(a+2b)^2}$
44. $\sqrt[5]{x^2y^3}$
45. $2x\sqrt[3]{x^2y}$
46. $xy\sqrt[4]{xy^3}$

In Exercises 47–50, convert to radical form.

47. $a^{3/4}b^{1/4}$
48. $x^{2/3}y^{1/3}$
49. $x^{-5/3}$
50. $(xy)^{-3/4}$

In Exercises 51–56, write using a single radical.

51. $\sqrt{\sqrt{2x}}$
52. $\sqrt{\sqrt[3]{3x^2}}$
53. $\sqrt[4]{\sqrt{xy}}$
54. $\sqrt[3]{\sqrt{ab}}$
55. $\frac{\sqrt[5]{a^2}}{\sqrt[3]{a}}$
56. $\sqrt{a}\sqrt[3]{a^2}$

In Exercises 57–64, simplify the exponential expression.

57. $\frac{a^{3/5}a^{1/3}}{a^{3/2}}$
58. $(x^2y^4)^{1/2}$
59. $(a^{5/3}b^{3/4})(3a^{1/3}b^{5/4})$
60. $\left(\frac{x^{1/2}}{y^{2/3}}\right)^6$
61. $\left(\frac{-8x^6}{y^{-3}}\right)^{2/3}$
62. $\frac{(p^2q^4)^{1/2}}{(27q^3p^6)^{1/3}}$
63. $\frac{(x^9y^6)^{-1/3}}{(x^6y^2)^{-1/2}}$
64. $\left(\frac{2x^{1/2}}{y^{2/3}}\right)\left(\frac{3x^{-2/3}}{y^{1/2}}\right)$

In Exercises 65–74, simplify the radical expression.

65. $\sqrt{9x^{-6}y^4}$
66. $\sqrt{16y^8z^{-2}}$
67. $\sqrt[4]{\frac{3x^8y^2}{8x^2}}$
68. $\sqrt[5]{\frac{4x^6y}{9x^3}}$
69. $\sqrt[3]{\frac{4x^2}{y^2}}\cdot\sqrt[3]{\frac{2x^2}{y}}$
70. $\sqrt[5]{9ab^6}\cdot\sqrt[5]{27a^2b^{-1}}$
71. $3\sqrt{48}-2\sqrt{108}$
72. $2\sqrt{175}-4\sqrt{28}$
73. $\sqrt{x^3}-\sqrt{4xy^2}$
74. $\sqrt{18x^2y}+\sqrt{2y^3}$

In Exercises 75–82, replace ○ with $<$, $=$, or $>$ to make a true statement.

75. $\sqrt{2+6}\ \bigcirc\ \sqrt{2}+\sqrt{6}$
76. $\sqrt{4}+\sqrt{9}\ \bigcirc\ \sqrt{4+9}$
77. $(3^{-2})^{-1/2}\ \bigcirc\ 3$
78. $(2^{-3})^{1/3}\ \bigcirc\ 2$
79. $\sqrt[4]{(-2)^4}\ \bigcirc\ -2$
80. $\sqrt[3]{(-2)^3}\ \bigcirc\ -2$
81. $2^{2/3}\ \bigcirc\ 3^{3/4}$
82. $4^{-2/3}\ \bigcirc\ 3^{-3/4}$

83. The time t (in seconds) that it takes for a pendulum to complete one cycle is approximately $t = 1.1\sqrt{L}$, where L is the length (in feet) of the pendulum. How long is the period of a pendulum of length 10 ft?

84. The time t (in seconds) that it takes for a rock to fall a distance d (in meters) is approximately $t = 0.45\sqrt{d}$. How long does it take for the rock to fall a distance of 200 m?

85. **Writing to Learn** Explain why $\sqrt[n]{a}$ and a real nth root of a need not have the same value.