



2019 Summer Math Packet (completed Algebra III → going into Pre-Calculus)

Congratulations, you made it through your math class this year! Your fabulous prize will be an even more challenging and interesting math class for next year. Yay!

Here is a packet to do over the summer to keep your math skills sharp, because we want you to be ready for your new math class in the fall. Do the indicated page(s) each week during the summer. You will find dates on the pages.

Complete your summer packet on separate paper without using a calculator, and remember to show all of your work. Do not do the whole packet right away, or you will forget some of the concepts before the fall. Do not leave the packet until the end of the summer, or you will have forgotten some of the concepts.

You have learned how to do everything in this packet at some point during the year, there is nothing new. Use your notes to help you with the packet. If you get completely stuck, then give one of us a call.

Bring the packet with you to your new math class in the fall. You will have a quiz during the first week of class to make sure you have done the packet and are ready for your new math class. Your math teacher might even give you extra credit for your summer math packet. Who doesn't love extra credit?

Have a wonderful and slightly mathematical summer!

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Algebra Rules

Cross multiplying

$$\frac{a}{b} = \frac{c}{d} \text{ means } ad = bc$$

Exponents

$$x^0 = 1$$

$$\sqrt{x} = x^{\frac{1}{2}}$$

$$x^a \cdot x^b = x^{a+b}$$

$$(x^a)^b = x^{a \cdot b}$$

$$x^{-a} = \frac{1}{x^a}$$

$$\frac{x^a}{x^b} = x^{a-b}$$

$$(xy)^a = x^a y^a$$

$$\left(\frac{x}{y}\right)^a = \frac{x^a}{y^a}$$

Factoring

$$x^2 + (a+b)x + ab = (x+a)(x+b)$$

$$ab + ac = a(b+c)$$

$$a^2 - b^2 = (a+b)(a-b)$$

Multiplying binomials

$$(ax+b)(cx+d) = acx^2 + (ad+bc)x + bd$$

Fractions

$$\frac{ab}{cd} = \frac{a}{c} \cdot \frac{b}{d}$$

$$\frac{ab}{ac} = \frac{b}{c}$$

$$\frac{a+b}{c} = \frac{a}{c} + \frac{b}{c}$$

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c}$$

$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

$$\frac{a}{c} - \frac{b}{c} = \frac{a-b}{c}$$

Quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Radicals

$$\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$$

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$$

$$a\sqrt{b} + c\sqrt{b} = (a+c)\sqrt{b}$$

$$a\sqrt{b} \cdot c\sqrt{d} = ac\sqrt{bd}$$

$$\frac{\sqrt{a}}{\sqrt{b}} \cdot \frac{\sqrt{b}}{\sqrt{b}} = \frac{\sqrt{ab}}{b}$$

$$a\sqrt{b^2c} = a\sqrt{b^2}\sqrt{c} = ab\sqrt{c}$$

1. $\frac{-2^{-2}}{(-2)^2}$

2. $\frac{2+3\sqrt{6}}{\sqrt{2}}$

3. $w^2 - 5w + 7 = 5w - 17$

4. $\frac{k}{4} - \frac{k+6}{5} = 1$

5. $\frac{a^2 + \frac{1}{a}}{ax + \frac{b}{a}}$

6. $\frac{\sqrt{2}}{\sqrt{5}}$

Simplify or solve

Week #2 6/16-6/22

7. $\frac{-2^{-2}}{-(-2^0)^{-3}}$

8. $3\sqrt{2}(4\sqrt{8} - 3\sqrt{12})$

9. $(x+1)^2 = 9$

10. $\frac{5l}{3} - \frac{l-5}{2} = 14$

11. $\frac{\frac{-15c^2}{3c+12}}{\frac{5c^3-5c}{3c^2+14c+8}}$

12. $\frac{4+2\sqrt{10}}{\sqrt{5}}$

Simplify or solve

Week #3 6/23-6/29

$$13. \frac{-3a - 9a^2}{-3a}$$

$$14. (3 + 2\sqrt{2})(5 - 3\sqrt{2})$$

$$15. 2y^2 + 3y = -1$$

$$16. \frac{m+8}{3m} = \frac{5}{2m} + \frac{1}{4}$$

$$17. \frac{4}{d^2 - 4} + \frac{3d}{d - 2}$$

$$18. 63 = -u^2 - 16u$$

Simplify or solve

Week #4 6/30-7/6

$$19. \frac{5b^2 - 5b}{5b}$$

$$20. (\sqrt{2}q + \sqrt{3}r)^2$$

$$21. x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \text{ where } a = 10, b = 13, 8c = 5$$

$$22. \frac{n-4}{n} = \frac{16}{5n} - \frac{1}{5}$$

$$23. \frac{4}{f^2 - 9} - \frac{3}{f + 3}$$

$$24. -81 + 4v^2 = 0$$

Simplify or solve

Week #5 7/7-7/13

25. $\frac{c^2 - ac^2 - 3c^3}{c^2}$

26. $3\sqrt{30,000} - 9\sqrt{300} + 3\sqrt{2}$

27. $2\sqrt{z} + 2 = 5$ $2y^2 + 3y = -1$

28. $9p^2 + 6p + 1$

29. $\frac{4}{g-2} + \frac{6g}{g^2-4}$

30. $\frac{9}{2}h + \frac{3}{5} = \frac{1}{4}$

Simplify or solve

Week #6 7/14-7/20

31. $\frac{4d^2 fg - 4dfg}{4dfg}$

32. $3\sqrt{6,000,000} - 5\sqrt{60,000} + 2\sqrt{3}(3\sqrt{2} - 5\sqrt{3})$

33. $a = 2b$ and $a = -b + 6$

34. $5q^2 + 2q - 7$

35. $\frac{5}{h+4} - \frac{3}{h^2+2h-8}$

36. $\frac{j}{4} - \frac{j+2}{6} = 4$

Simplify or solve

Week #7 7/21-7/27

$$37. \frac{h^2 j (h^2 j) (h^{-2})^2 j^0 h j^2}{(j^{-3})^2 j h^{-2} h^4 h}$$

$$38. \sqrt{50,000} - 25\sqrt{125} + 5\sqrt{5}(5\sqrt{5} - 5)$$

$$39. \frac{3}{4c} = \frac{3}{c+3}$$

$$40. 6r^2 - 17r + 5$$

$$41. \frac{5}{j+2} - \frac{3j}{j^2 + 5j + 6}$$

$$42. \frac{6x^2 + 2x^3}{2x^2 + 12x + 18}$$

Simplify or solve

Week #8 7/28-8/3

$$43. \frac{4k^2 l^{-2} (k^2)^{-2} l^2 kl}{(2k^0)^2 k^2 l^{-2} (kl)}$$

$$44. (3\sqrt{2})4\sqrt{3} - 4\sqrt{60,000} + 2\sqrt{3}(3\sqrt{2} - \sqrt{3})$$

$$45. \frac{2}{d} - \frac{3}{d-1} = 0$$

$$46. 25s^2 - t^2$$

$$47. -\frac{k}{k+5} - \frac{3k}{k^2 + 3k - 10}$$

$$48. \frac{\frac{5y}{3} - 4}{\frac{z}{-} - z}$$

Simplify or solve

Week #9 8/4-8/10

$$49. m^0 - 3m(2 - 4^0) - (-3) - 2(m - 3) = 3m - (-4)$$

$$50. 35 = -12s - s^2$$

$$51. \frac{4}{f} - \frac{2}{f-4} = 0$$

$$52. 2u^2v + 6u^2 - 5v - 15$$

$$53. \frac{4}{l^2} - \frac{l+3}{4l} - \frac{2l}{l+1}$$

$$54. \frac{7}{n^2 - 5n - 6} - \frac{5}{n^2 - 6n}$$

Simplify or solve

Week #10 8/11-8/17

$$55. 2n^0(n-2) - 3n - 4 - [-(-2)] - 7^0 = -2n - 4$$

$$56. -80 = t^2 + 18t$$

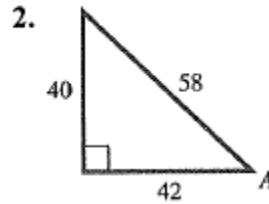
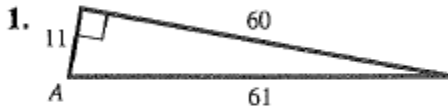
$$57. \frac{1+g}{g} - \frac{3}{g} = 0$$

$$58. \frac{2w^3 + w^2 - 3w}{2w+3}$$

$$59. \frac{m}{m+4} + \frac{3}{m} - \frac{m+2}{m^2}$$

$$60. \frac{p}{q^2-9} + \frac{2q}{q^2-3q}$$

Find the values of the six trigonometric functions for each angle A .



Find one solution for each equation. Assume that all angles are acute angles.

3. $\sin 4\beta = \cos 5\beta$

4. $\sec(2\theta + 10^\circ) = \csc(4\theta + 20^\circ)$

5. $\tan(5x + 11^\circ) = \cot(6x + 2^\circ)$

6. $\cos\left(\frac{3\theta}{5} + 11^\circ\right) = \sin\left(\frac{7\theta}{10} + 40^\circ\right)$

True or False Tell whether each statement is true or false. If false, tell why.

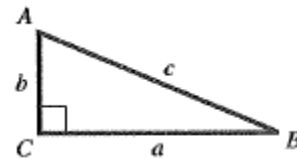
7. $\sin 46^\circ < \sin 58^\circ$

8. $\cos 47^\circ < \cos 58^\circ$

9. $\sec 48^\circ \geq \cos 42^\circ$

10. $\sin 22^\circ \geq \csc 68^\circ$

11. Explain why, in the figure, the cosine of angle A is equal to the sine of angle B .



Find exact values of the six trigonometric functions for each angle. Do not use a calculator. Rationalize denominators when applicable.

12. 120°

13. 1020°

14. -225°

15. -1470°

Find all values of θ , if θ is in the interval $[0^\circ, 360^\circ)$ and θ has the given function value.

16. $\sin \theta = -\frac{1}{2}$

17. $\cos \theta = -\frac{1}{2}$

18. $\cot \theta = -1$

19. $\sec \theta = -\frac{2\sqrt{3}}{3}$

Evaluate each expression. Give exact values.

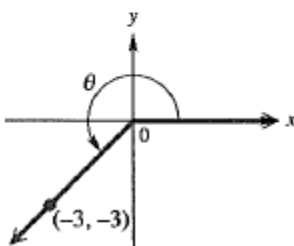
20. $\cos 60^\circ + 2 \sin^2 30^\circ$

21. $\tan^2 120^\circ - 2 \cot 240^\circ$

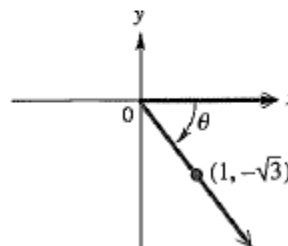
22. $\sec^2 300^\circ - 2 \cos^2 150^\circ + \tan 45^\circ$

23. Find the sine, cosine, and tangent function values for each angle.

(a)



(b)



Use a calculator to find each value.

24. $\sin 72^\circ 30'$

25. $\sec 222^\circ 30'$

26. $\cot 305.6^\circ$

27. $\csc 78^\circ 21'$

28. $\sec 58.9041^\circ$

29. $\tan 11.7689^\circ$

30. *Multiple Choice* Which one of the following cannot be *exactly* determined using the methods of this chapter?

- A. $\cos 135^\circ$ B. $\cot(-45^\circ)$ C. $\sin 300^\circ$ D. $\tan 140^\circ$

Use a calculator to find each value of θ , where θ is in the interval $[0^\circ, 90^\circ)$. Give answers in decimal degrees.

31. $\sin \theta = 0.82584121$

32. $\cot \theta = 1.1249386$

33. $\cos \theta = 0.97540415$

34. $\sec \theta = 1.2637891$

35. $\tan \theta = 1.9633124$

36. $\csc \theta = 9.5670466$

Find two angles in the interval $[0^\circ, 360^\circ)$ that satisfy each of the following. Leave answers in decimal degrees rounded to the nearest tenth.

37. $\sin \theta = 0.73254290$

38. $\tan \theta = 1.3865342$

True or False Tell whether each statement is true or false. If false, tell why. Use a calculator for Exercises 39 and 42.

39. $\sin 50^\circ + \sin 40^\circ = \sin 90^\circ$

40. $\cos 210^\circ = \cos 180^\circ \cdot \cos 30^\circ - \sin 180^\circ \cdot \sin 30^\circ$

41. $\sin 240^\circ = 2 \sin 120^\circ \cdot \cos 120^\circ$

42. $\sin 42^\circ + \sin 42^\circ = \sin 84^\circ$

43. A student wants to use a calculator to find the value of $\cot 25^\circ$. However, instead of entering $\frac{1}{\tan 25^\circ}$, he enters $\tan^{-1} 25$. Assuming the calculator is in degree mode, will this produce the correct answer? Explain.

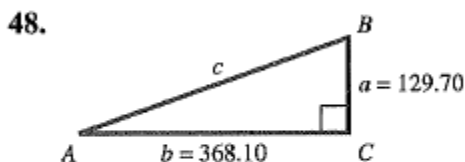
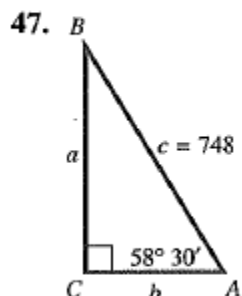
For each angle θ , use a calculator to find $\cos \theta$ and $\sin \theta$. Use your results to decide in which quadrant the angle lies.

44. $\theta = 2976^\circ$

45. $\theta = 1997^\circ$

46. $\theta = 4000^\circ$

Solve each right triangle. In Exercise 48, give angles to the nearest minute. In Exercises 49 and 50, label the triangle ABC as in Exercises 47 and 48.



49. $A = 39.72^\circ, b = 38.97 \text{ m}$

50. $B = 47^\circ 53', b = 298.6 \text{ m}$

Algebra Answers

1. $-\frac{1}{16}$

2. $\sqrt{2} + 3\sqrt{3}$

3. $w = 6, w = 4$

4. $k = 44$

5. $\frac{a^3 + 1}{a^2x + b}$

6. $\frac{\sqrt{10}}{5}$

7. $-\frac{1}{4}$

8. $48 - 18\sqrt{6}$

9. $x = 2, x = -4$

10. $l = \frac{69}{7}$

11. $\frac{-c(3c + 2)}{(c - 1)(c + 1)}$

12. $\frac{4\sqrt{5} + 10\sqrt{2}}{5}$

13. $1 + 3a$

14. $3 + \sqrt{2}$

15. $y = -\frac{1}{2}, y = -1$

16. $m = -2$

17. $\frac{3d^2 + 6d + 4}{(d + 2)(d - 2)}$

18. $u = -9, u = -7$

19. $b - 1$

20. $2q^2 + 2\sqrt{6}qr + 3r^2$

21. $x = -\frac{1}{20}, x = -\frac{5}{4}$

22. $n = 6$

23. $\frac{-3f + 13}{(f + 3)(f - 3)}$

24. $v = \pm\frac{9}{2}$

25. $1 - a - 3c$

26. $210\sqrt{3} + 3\sqrt{2}$

27. $z = \frac{9}{4}$

28. $(3p + 1)^2$

29. $\frac{2(5g + 4)}{(g - 2)(g + 2)}$

30. $h = \frac{-7}{90}$

31. $d - 1$

32. $2506\sqrt{6} - 30$

33. $b = 2, a = 4$

34. $(q - 1)(5q + 7)$

35. $\frac{5h - 13}{(h + 4)(h - 2)}$

36. $j = 52$

37. $\frac{j^9}{h^2}$

38. $-50\sqrt{5} + 125$

39. $c = 1$

40. $(2r - 5)(3r - 1)$

41. $\frac{2j + 15}{(j + 2)(j + 3)}$

42. $\frac{x^2}{x + 3}$

43. $\frac{l^2}{k^4}$

44. $-382\sqrt{6} - 6$

45. $d = -2$

46. $(5s+t)(5s-t)$

47. $\frac{-k(k+1)}{(k+5)(k-2)}$

48. $\frac{5y-4z}{3-z^2}$

49. $m = \frac{3}{4}$

50. $s = -7, s = -5$

51. $f = 8$

52. $(2u^2 - 5)(v+3)$

53. $\frac{-9l^3 - 4l^2 + 13l + 16}{4l^2(l+1)}$

54. $\frac{2n-5}{n(n-6)(n+1)}$

55. $n = 7$

56. $t = -10, t = -8$

57. $g = 2$

58. $w(w-1)$

59. $\frac{m^3 + 2m^2 + 6m - 8}{m^2(m+4)}$

60. $\frac{p+2q+6}{(q+3)(q-3)}$

Trig Answers

1. $\sin A = \frac{60}{61}$

$\cos A = \frac{11}{61}$

$\tan A = \frac{60}{11}$

$\cot A = \frac{11}{60}$

$\sec A = \frac{61}{11}$

$\csc A = \frac{61}{60}$

2. $\sin A = \frac{20}{29}$

$\cos A = \frac{21}{29}$

$\tan A = \frac{20}{21}$

$\cot A = \frac{21}{20}$

$\sec A = \frac{29}{21}$

$\csc A = \frac{29}{20}$

3. $\beta = 10^\circ$

4. $\theta = 10^\circ$

5. $x = 7^\circ$

6. $\theta = 30^\circ$

7. True

8. False

9. True

10. False

11. Explain

12. $\sin 120^\circ = \frac{\sqrt{3}}{2}$

$\cos 120^\circ = -\frac{1}{2}$

$\tan 120^\circ = -\sqrt{3}$

$\cot 120^\circ = -\frac{\sqrt{3}}{3}$

$\sec 120^\circ = -2$

$\csc 120^\circ = \frac{2\sqrt{3}}{3}$

13. $\sin 1020^\circ = -\frac{\sqrt{3}}{2}$

$\cos 1020^\circ = \frac{1}{2}$

$\tan 1020^\circ = -\sqrt{3}$

$\cot 1020^\circ = -\frac{\sqrt{3}}{3}$

$\sec 1020^\circ = 2$

$\csc 1020^\circ = -\frac{2\sqrt{3}}{3}$

$$14. \sin(-225^\circ) = \frac{\sqrt{2}}{2}$$

$$\cos(-225^\circ) = -\frac{\sqrt{2}}{2}$$

$$\tan(-225^\circ) = -1$$

$$\cot(-225^\circ) = -1$$

$$\sec(-225^\circ) = -\sqrt{2}$$

$$\csc(-225^\circ) = \sqrt{2}$$

$$15. \sin(-1470^\circ) = -\frac{1}{2}$$

$$\cos(-1470^\circ) = \frac{\sqrt{3}}{2}$$

$$\tan(-1470^\circ) = -\frac{\sqrt{3}}{3}$$

$$\cot(-1470^\circ) = -\sqrt{3}$$

$$\sec(-1470^\circ) = \frac{2\sqrt{3}}{3}$$

$$\csc(-1470^\circ) = -2$$

$$16. \theta = 210^\circ, 330^\circ$$

$$17. \theta = 120^\circ, 240^\circ$$

$$18. \theta = 135^\circ, 315^\circ$$

$$19. \theta = 150^\circ, 210^\circ$$

$$20. 1$$

$$21. 3 - \frac{2\sqrt{3}}{3}$$

$$22. \frac{7}{2}$$

$$23. a) \sin \theta = -\frac{\sqrt{2}}{2}$$

$$\cos \theta = -\frac{\sqrt{2}}{2}$$

$$\tan \theta = 1$$

$$b) \sin \theta = -\frac{\sqrt{3}}{2}$$

$$\cos \theta = \frac{1}{2}$$

$$\tan \theta = -\sqrt{3}$$

$$24. \approx 0.95$$

$$25. \approx -1.36$$

$$26. \approx -0.72$$

$$27. \approx 1.02$$

$$28. \approx 1.94$$

$$29. \approx 0.21$$

$$30. D$$

$$31. \theta \approx 55.67^\circ$$

$$32. \theta \approx 41.64^\circ$$

$$33. \theta \approx 12.73^\circ$$

$$34. \theta \approx 37.70^\circ$$

$$35. \theta \approx 63.01^\circ$$

$$36. \theta \approx 6.00^\circ$$

$$37. 47.1^\circ, 132.9^\circ$$

$$38. 54.2^\circ, 234.2^\circ$$

$$39. \text{False}$$

$$40. \text{True}$$

$$41. \text{True}$$

$$42. \text{False}$$

$$43. \text{No, explain}$$

$$44. \text{Quadrant II}$$

$$45. \text{Quadrant III}$$

$$46. \text{Quadrant I}$$

$$47. a \approx 637.77 \text{ units}$$

$$b \approx 390.83 \text{ units}$$

$$c = 748 \text{ units}$$

$$A = 58^\circ 30'$$

$$B = 31^\circ 30'$$

$$C = 90^\circ$$

$$48. a = 129.70 \text{ units}$$

$$b = 368.10 \text{ units}$$

$$c \approx 390.28 \text{ units}$$

$$A \approx 19^\circ 25'$$

$$B \approx 70^\circ 35'$$

$$C = 90^\circ$$

$$49. a \approx 32.38m$$

$$b = 38.97m$$

$$c \approx 50.66m$$

$$A = 39.72^\circ$$

$$B = 50.28^\circ$$

$$C = 90^\circ$$

$$50. a \approx 270.00m$$

$$b = 298.6m$$

$$c \approx 402.5m$$

$$A = 42^\circ 7'$$

$$B = 47^\circ 53'$$

$$C = 90^\circ$$