Honors Algebra 2 – Final Exam Review 2018

- GET ORGANIZED. Successful studying begins with being organized. Gather up all of your notes from this semester. Bring this packet with you to class every day.

- DO NOT FALL BEHIND. Do the problems that are assigned every night and come to class prepared to ask about the things you could not do.

- GET SERIOUS. The grade you earn on this exam is worth 20% of your semester grade.

- MAKE NOTES AS YOU WORK. Write yourself some reminders, explanations, etc. We will likely have homework quizzes throughout the week.

- BE ABLE TO DO THE PROBLEMS AS YOU WILL BE ASKED ON THE EXAM. Throughout the packet, \(4-F\) means that you will only get a 4-function calculator. \(SC\) means that you will get a scientific (not graphing) calculator.

- This packet is an entire week’s worth of homework. You will turn it in after you take your exam. This grade is based on:
  - Completion. I will check each day to make sure that day’s work is done.
  - Correctness. I will check random problems to make sure they are correct, or that you made corrections as needed.

### Assignments

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<td>Optional extra prep: Do “extra practice” questions, redo hard problems, do trig evens</td>
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Simplify each expression. 4-F

1. \( \frac{4a^2-9}{10a+15} \)
2. \( \frac{cd-2d^2+c^2}{c^2-4cd+3d^2} \)
3. \( \frac{x^4-2x^2y^2+y^4}{x^4-x^3y-xy^3+y^4} \)

4. \( \frac{a^3+27}{a^2-9} \)
5. \( \frac{5a^2+4a-1}{5a^2-10a-15} \)
6. \( \frac{20x-5x^2}{x^2-16} \)

Simplify each expression. Determine the domain of the function and find the zeros. 4-F

7. \( f(x) = \frac{2x^2-7x+3}{x^2+2x^2-3x} \)
8. \( g(x) = \frac{4x^2+15x-4}{(2x-1)^2} \)

9. \( f(z) = (z^4 - 5z^3 + 6z^2)(9z - z^3)^{-1} \)
10. \( f(x) = \frac{x^2+27}{x^2+9} \)

Simplify each expression. 4-F

11. \( \frac{2x}{3z} \cdot \frac{4x}{5y} \)
12. \( \frac{5c^4}{9a^2} \div \frac{2a}{3c^7} \)
13. \( \frac{r^4s}{t} \cdot \frac{t^3}{r^2s} \div \frac{rs}{t} \)

14. \( \frac{3x^2-8x+4}{9x^2-4} \div \frac{3x^2-5x-2}{9x^2-3x-2} \)
15. \( \frac{x^2+3ax}{3a-x} \cdot \frac{x^2-4ax+3a^2}{a^2-x^2} + \frac{x+3a}{x+a} \)
16. \( \frac{-7v}{2u^2-5uv-3v^2} - \frac{1}{3v-u} \)  
17. \( \frac{x+1}{x^2+4x+4} - \frac{6}{x^2-4} \)  
18. \( \frac{5}{y^2-y} - \frac{1}{y^2-1} \)

19. \( \frac{1}{x+1} - \frac{1}{x} \)  
20. \( \frac{1}{x} - \frac{1}{y} \)  

21. \( \frac{1}{1-\frac{1}{t-1}} \)  
22. \( \frac{x^2 - y^2}{x+y} \)  

\(\frac{x^2}{x^3} + \frac{1}{x} = \frac{4}{x^2+2x-3} \)  
\(\frac{1}{x+1} - \frac{1}{x+2} = 1 \)

**Solve. Be sure to check for extraneous solutions.**

23. \( \frac{6}{x-3} = \frac{8x^2}{x^2-9} - \frac{4x}{x+3} \)  
24. \( \frac{x+1}{x+6} + \frac{1}{x} = \frac{2x+1}{x+6} \)  
25. \( \frac{2}{x-3} + \frac{1}{x} = \frac{x-1}{x-3} \)
28. A pharmacist wishes to make 1.8 L of a 10% solution of boric acid by mixing 7.5% and 12% solutions. How much of each type of solution should be used?  

29. Pipes A and B can fill a storage tank in 8 h and 12 h respectively. With the tank empty, pipe A was turned on at noon and then pipe B was turned on at 1:30 PM. At what time did the tank fill?  

30. An excursion boat traveled 35 km upstream and then back again in 4 h 48 min. If the speed of the boat in still water is 15 km/h, what is the speed of the current?  

31. \( f(x) = \frac{2x}{x-3} \)  
32. \( g(x) = \frac{x-5}{x^2-2x-24} \)  

33. Graph the functions \( f(x) = \frac{5}{x+2} - 1 \). Find a) horizontal and vertical asymptotes, b) x- and y-intercepts, and c) domain and range. Be sure to include End Behavior Sentences.  

\[ \text{SC} \]
34. Graph the function \( f(x) = \frac{2x+5}{x^2+3} \). Find a) horizontal and vertical asymptotes, b) x- and y-intercepts, and c) domain and range. Be sure to include End Behavior Sentences. 

35. Graph the function \( f(x) = \frac{2x}{x^2-4} \). Find a) horizontal and vertical asymptotes, b) x- and y-intercepts, and c) domain and range. Be sure to include End Behavior Sentences. 

36. Graph the function \( f(x) = \frac{x^2}{x^2-9} \). Find a) horizontal and vertical asymptotes, b) x- and y-intercepts, and c) domain and range. Be sure to include End Behavior Sentences.
Write a formula for the measures of all angles coterminal with the given angle. Then use the formula to find two angles, one positive and one negative, that are coterminal with the given angle.

1. \( \theta = 670^\circ \)

2. \( \frac{13\pi}{8} \)

Express in either “Decimal Degrees” or in “Degrees Minutes Seconds” to the nearest second.

3. \( 23^\circ 27' 8'' \)

4. \( 102.39^\circ \)

Find a first-quadrant angle \( \theta \), for which an angle five times as large as \( \theta \) will be in the given quadrant.

5. Quadrant 2

6. Quadrant 4

7. Find the six trig functions of \( \theta \)

8. If \( \cos \theta = \frac{2}{7} \), and \( \csc \theta < 0 \) find the other five trig functions.

Find the exact value for \( x \) and \( y \).

9.

\[
\begin{align*}
\theta &= 60^\circ \\
x &= 7 \\
\end{align*}
\]

10.

\[
\begin{align*}
\theta &= 45^\circ \\
x &= \frac{13}{2} \\
\end{align*}
\]

11.

\[
\begin{align*}
\theta &= 60^\circ \\
x &= 38 \\
\end{align*}
\]

12.

\[
\begin{align*}
\theta &= 60^\circ \\
x &= 24 \\
\end{align*}
\]

13.

\[
\begin{align*}
\theta &= 45^\circ \\
x &= 6 \\
\end{align*}
\]
**Draw a picture for each! Round all answers to the nearest thousandth.**

14. An airplane is at an elevation of 45,000 ft when it begins its approach to an airport. Its angle of descent is 3°. What is the approximate air distance between the plane and the airport?

15. A window washer 50 ft above the ground sees a parked car 153 ft away. What is the angle of depression from the man to the car?

16. Find the measures of the angles of an isosceles triangle whose sides are 5, 10, and 10.

17. Two farmers stand on the same side of a silo 10 feet apart. The angles of elevation to the top of the silo are 25° and 30° respectively. How far is each farmer from the silo? How high is the silo?

18. While traveling across flat land, you notice a mountain directly in front of you. The angle of elevation to the peak is 7°. After you drive 10 miles closer to the mountain, the angle of elevation is 18°. Approximate the height of the mountain.

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**Convert from Radians to Degrees, or Degrees to Radians.**

19. 80°  
20. $\frac{11\pi}{3}$  
21. 225°  
22. $\frac{9\pi}{4}$
From the information given, find the quadrant in which $\theta$ lies. 4-F

23. $\sin \theta > 0, \tan \theta < 0$  
24. $\csc \theta > 0, \sec \theta < 0$

Find the exact value of the function. 4-F

25. $\sec 150^\circ$  
26. $\tan \frac{3\pi}{4}$  
27. $\sin 300^\circ$

28. $\csc \frac{3\pi}{2}$  
29. $\cot 30^\circ$  
30. $\cos \frac{11\pi}{6}$

31. Find the value of all six trig functions at each quadrantal angle. 4-F

Express as the function of an acute angle. 4-F

32. $\cos 330^\circ$  
33. $\sin 225^\circ$

34. Find the $\cot \theta$ if $\sin \theta = \frac{3}{5}$ and $\cos \theta < 0$.  
35. Find $\cos x = -\frac{\sqrt{2}}{2}$ when $-\pi < x < 0$.

Are the following points on the unit circle? Show your work. 4-F

36. $\left(\frac{21}{29}, \frac{-20}{29}\right)$  
37. $\left(-\frac{\sqrt{10}}{10}, \frac{3\sqrt{10}}{10}\right)$
Solve the following triangles. Round all answers to the nearest tenth. 

38. $A = 29^\circ$, $a = 6$, $b = 13$

39. $A = 66^\circ$, $a = 12$, $b = 7$

40. $A = 45^\circ$, $a = 15$, $b = 18$

41. $a = 8$, $b = 6$, $c = 9$

42. In $\triangle RST$, $R = 49.8^\circ$, $S = 67.5^\circ$, $r = 16$
   Find $t$

43. In $\triangle RST$, $T = 75^\circ$, $s = 20$, $r = 15$
   Find $t$

44. Two snowmobilers start from the same point and drive at 8 km/h and 13 km/h, respectively, diverging at an angle of $100^\circ$. Three hours after leaving, they find that their radio transmissions are barely audible. How far apart are they at that time? Round to the nearest thousandth. 

45. A triangle has sides of lengths 7, 12 and 10. Find the measure of the smallest angle to the nearest tenth of a degree.
46. Jan is flying a plane on a triangular course at 450 mi/h. She flies due east for four hours and then turns right through a $50^\circ$ angle. How long after turning will she be exactly southeast of where she started?  

47. Find the length of an arc that subtends a central angle of $45^\circ$ in a circle with radius 10 m.  

48. Find the area of a sector with central angle $60^\circ$ in a circle with radius 3 mi.  

49. A woman is riding a bicycle whose wheels are 28 in. in diameter. If the wheels rotate at 130 revolutions per minute (rpm), find the speed at which she is traveling in mi/h.  

50. A boy rotates a stone in a 3 ft. long sling at the rate of 15 revolutions every 10 seconds. Find the linear and angular velocities of the stone.  

**Determine whether each function is even, odd, or neither.**

51. $f(x) = \frac{1}{6} + x$  
52. $f(x) = x^2 + 3x$  
53. $f(x) = x^8$  
54. $f(x) = x^7$  

**State the amplitude, period, vertical shift and phase shift. Graph and Identify the Domain & Range.**

55. $y = 3 \cos 3x$  
   Amplitude:  
   Period:  
   Phase Shift:  
   Vertical Shift:
56. \( y = -\frac{1}{2} \sin \frac{x}{2} \)

Amplitude: 

Period: 

Phase Shift: 

Vertical Shift: 

57. \( y = \sin(2x - \pi) + 1 \)

Amplitude: 

Period: 

Phase Shift: 

Vertical Shift: 

58. \( y = 2 \cos(2\pi x - \pi) + \frac{1}{2} \)

Amplitude: 

Period: 

Phase Shift: 

Vertical Shift: 

59. \( y = -\tan \theta - 2 \)

Amplitude: 

Period: 

Phase Shift: 

Vertical Shift:
60. \( y = 3 \cot \left( \theta + \frac{\pi}{2} \right) \)

Amplitude:

Period:

Phase Shift:

Vertical Shift:

**Find the exact value of each expression, if it is defined. Please leave answers in radians. 4-F**

61. \( \sin^{-1} \frac{1}{2} \)

62. \( \cos^{-1} \left( -\frac{\sqrt{3}}{2} \right) \)

63. \( \tan^{-1} 0 \)

64. \( \sin^{-1} (0) \)

65. \( \cos^{-1} (1) \)

66. \( \sec^{-1} \left( -\frac{2\sqrt{3}}{3} \right) \)

67. \( \csc^{-1} \sqrt{2} \)

68. \( \cot^{-1} \left( -\frac{\sqrt{3}}{3} \right) \)

69. \( \csc^{-1} (1) \)

70. \( \tan \left( \sin^{-1} \frac{\sqrt{2}}{2} \right) \)

71. \( \sin \left( \tan^{-1} \frac{12}{5} \right) \)

72. \( \csc \left( \cos^{-1} \frac{7}{25} \right) \)

73. \( \sin^{-1} \left( \sin \frac{7\pi}{4} \right) \)

74. \( \cos^{-1} \left( \cos \left( -\frac{\pi}{3} \right) \right) \)

75. \( \cot \left( \sin^{-1} \frac{1}{2} \right) \)

**Simplify. 4-F**

76. \( \frac{\sec \theta}{\cos \theta} - \sec \theta \cos \theta \)

77. \( \frac{1-\cos^2 x}{\sin x \cos x} \)
78. \[ \frac{\sin 2x}{1-\cos 2x} \]  
79. \( \sin^2 x + \cos^2 x + \tan^2 x \)

80. \[ \frac{\sin x + \cos x}{\tan x + \cot x} \]  
81. \[ \frac{\cos x + 1-\sin x}{1-\cos x} \]

82. \[ \frac{\cos^2 x - \sin^2 x}{1-\tan^2 x} \]  
83. \[ \frac{\tan^2 x}{\sec x} \]

**Use the sum and difference formulas to find the exact value.** 4-F

84. \( \cos 195° \)  
85. \( \sin 255° \)

**Find \( \sin 2x, \cos 2x, \) and \( \tan 2x \) from the given information.** 4-F

86. \( \cos x = \frac{4}{5}; \csc x < 0 \)  
87. \( \csc x = 4; x \) in quadrant II

**Use the half-angle formulas to find the exact value.** 4-F

88. \( \sin 22.5° \)  
89. \( \tan 67.5° \)  
90. \( \cos 112.5° \)
Solve for $\alpha$, $0^\circ \leq \alpha < 360^\circ$. Solve for $x$, $0 \leq x < 2\pi$. Round your answer to the nearest thousandth. SC

91. $5\sin^2 \alpha - 2 = 0$
92. $\tan^2 x - 9 = 0$

Find the formulas giving the general solution for each given $0 \leq x < 2\pi$ and $0^\circ \leq \alpha < 360^\circ$. Your answers must be exact. 4-F

93. $\sin x + 1 = 0$
94. $\sqrt{2} \cos \left(x + \frac{\pi}{2}\right) + 1 = 0$

95. $\csc^2 x - 4 = 0$
96. $\tan x \sin x + \sin x = 0$

97. $2\cos 2\alpha = \sqrt{3}$
98. $\sin \alpha = 1 + \cos^2 \alpha$

Find all solutions of the equation in the interval $[0, 2\pi)$. 4-F

99. $4\sin^2 \theta = 3$
100. $2\cos^2 \theta = 1$

101. $\sin 2x = -\sin x$
102. $\sin x \tan x = 0$
1. A briefcase lock has 3 rotating cylinders each containing 10 digits. How many numerical codes are possible? \(4\-F\)

2. Allan is playing the role of Oliver in his school’s production of *Oliver Twist*. The wardrobe crew has presented Allan with 5 pairs of pants and 4 shirts that he can wear. How many possible costumes consisting of a pair of pants and a shirt does Allan have to choose from? \(4\-F\)

3. A Mexican restaurant offers chicken, beef, or vegetarian fajitas wrapped with either corn or flour tortillas, and topped with either mild, medium or hot salsa. How many different choices of fajitas does a customer have? \(4\-F\)

4. How many 7-digit phone numbers can be formed if the first digit cannot be 0 or 1, and no digit can be repeated? \(4\-F\)

5. How can 8 students be seated in 8 seats in the front row of the school auditorium? \(4\-F\)

6. How many ways can you check out 3 library books from a list of 8 books for a research paper? \(SC\)

7. How many ways can you elect 4 candidates to a municipal planning board from a field of 7 candidates? \(SC\)

8. How many ways can 10 contestants finish a race in first, second, and third place? \(SC\)
9. A student council has 5 seniors, 4 juniors, 3 sophomores and 2 freshmen as members. In how many ways can a 4-member council committee be formed that includes one member from each class? 

10. How many ways are there to write a 3-digit positive integer using the digits 1, 3, 5, 7, and 9 if no digit is used more than once? 

11. Six representatives from a senior class of 350 students are to be chosen for the student council. In how many ways can these students be chosen to represent the senior class on the student council? 

Find the number of possible 5-card hands that contain the cards specified from a standard 52-card deck. 

12. 4 kings and one other card 

13. 5 hearts or 5 diamonds 

Find the number of distinguishable permutations in the following words. 

14. PROBABILITY 
15. PERMUTATION 
16. BEEKEEPER 

A letter is selected at random from those in the word TRIANGLE. Find the probability of each event 

17. It is a vowel. 
18. It is from the upper half of the alphabet. 

A card is randomly selected from a standard deck of 52 cards. Find the probability of drawing the given card. 

19. A red king 
20. A diamond or a 3 
21. Not a club 

Two cards are drawn at random from a 52-card deck without replacement. Find the probability of each event. 

22. Both are hearts. 
23. Both are jacks. 

24. Neither is red. 
25. Neither is a spade.
Two six sided dice are rolled, one blue and one red. Find the probability of the given event. 4-F
26. The sum is 3 or 9. 27. The sum is greater than 7 and less than 11.

Find the odds in favor of an event, given the probability of the event. 4-F
28. \( \frac{3}{7} \) 29. \( \frac{4}{5} \) 30. \( \frac{1}{15} \)

Find the probability of an event occurring, given the odds of the event. 4-F
31. 10:1 32. 4:9 33. 8:3

34. There are 3 nickels, 3 dimes and 5 quarters in a purse. Three coins are selected in succession at random. Find the probability of: SC
a. Drawing a nickel, then a dime, then a quarter if no replacement occurs
b. Drawing three quarters if replacement occurs
c. Drawing a nickel and then two quarters if no replacement occurs
d. Drawing three quarters if no replacement occurs

35. Serena is creating a painting. She wants to use 2 more colors. She chooses randomly from 6 shades of red, 10 shades of green, 4 shades of yellow, 4 shades of purple and 6 shades of blue. What is the probability that she chooses 2 shades of green? SC

36. Becky’s mother is shopping at the bakery. The owner offers Becky a cookie from a jar containing 22 chocolate chip cookies, 18 sugar cookies and 15 oatmeal cookies. Without looking, Becky selects one, drops it back in, and then randomly selects another. What is the probability that neither selection was a chocolate chip cookie? SC
Find a formula for the nth term, of each sequence. 4-F

1. 18, 11, 4, -3, . . .
2. 16, 24, 36, 54, . . .

Given the arithmetic sequence 9, 4, -1, . . . find each of the following. 4-F

3. The value of $t_{17}$
4. Which term is $-231$?
5. Find $S_{38}$

Write a rule for the nth term of the arithmetic sequence. 4-F

6. $d = 7$, $t_8 = 54$
7. $t_4 = 27$, $t_{11} = 69$

8. Insert three arithmetic means between 6 and 26. 4-F

Write a rule for the nth term of the geometric sequence. 4-F

9. $r = 5$, $t_7 = 200$
10. $t_3 = 16$, $t_5 = \frac{16}{9}$

11. Find $t_{10}$ of the geometric sequence 1, -2, 4, -8, 16, . . . 4-F

12. The temperature of water in a kettle is $50^\circ F$ when it is placed on the stove. Its temperature $n$ seconds after being placed on the stove is $7\%$ more than 1 second earlier. Find the temperature of the water
   a) 20 seconds and b) 1 minute after it is placed on the stove.
   Is this realistic? Sc
13. Find the sum of the first 20 terms of the geometric series \( \frac{3}{4} + \frac{3}{2} + 3 + 6 + \cdots \) SC

14. Find the geometric mean of \( \frac{1}{12} \) and \( \frac{1}{18} \). 4-F

15. Insert 4 geometric means between -4 and -972. 4-F

**Evaluate. You must use a formula when appropriate.**

16. \( \sum_{n=4}^{500} (2n - 1) \) 4-F

17. \( \sum_{k=3}^{10} 6(k)^{-2} \) SC

18. \( \sum_{k=1}^{5} \left( \frac{k}{3} \right)^{2} \) 4-F

19. Find the sum of the series: \( 24 - 4.8 + 0.96 - 0.192 + \cdots \) SC

**Write in sigma notation.** 4-F

20. \( \frac{1}{3} + \frac{2}{5} + \frac{3}{7} + \frac{4}{9} + \cdots \)

21. \( 2 + 2 \cdot 3 + 2 \cdot 3^2 + \cdots + 2 \cdot 3^8 \)

**Find the sum of each series. Note, for arithmetic and geometric series, you may use the formula. You must use other methods to find non-arithmetic and non-geometric sums.**

22. Odd integers from 100-350. 4-F

23. The positive four-digit integers divisible by 12. 4-F
Use Arithmetic and Geometric Sequences and Series to solve the following applications.

24. A small hardware store makes a profit of $10,000 during its first year. The store owner sets a goal of increasing profits by $700 each year for 7 years. Assuming that this goal is met, find the total profit during the first 8 years of business. 4-F

25. A bouncy ball is dropped from the top of a 200 foot building. It rebounds to 93% of its original height after each successive bounce. After bouncing and rebounding 15 times, how far has the ball traveled? SC
Determine the conic represented by the following equations. Then, find all necessary information and graph the following equations.

1. \((x + 5)^2 + (y - 2)^2 = 16\)

2. \((y - 1)^2 - \frac{(x-2)^2}{9} = 1\)

3. \(x = \frac{1}{8} (y + 1)^2 - 3\)

4. \(\frac{(x+1)^2}{9} + \frac{(y-2)^2}{4} = 1\)

5. \(\frac{(x-1)^2}{4} - \frac{(y+2)^2}{9} = 1\)

6. \(y = (x - 2)^2 + 1\)
7. \((y + 2)^2 = -12(x + 3)\)

8. \(\frac{(y+5)^2}{16} - \frac{(x+4)^2}{9} = 1\)

9. \(\frac{(x-4)^2}{36} + \frac{(y+2)^2}{7} = 1\)

10. \((x + 4)^2 + (y - 2)^2 = 25\)

Write an equation given the following information.

11. Circle: Center: \((-2, 4)\) through \((-7, 5)\)

12. Parabola: Vertex: \((-3, -4)\) Focus: \((-3, \frac{15}{4})\)

13. Parabola: Vertex: \((1, 3)\) Directrix: \(x = \frac{7}{8}\)


15. Hyperbola: Vertices: \((-4, 3)(-4.7)\) Foci: \((-4, 1)(-4, 9)\)
Identify each conic section and list all of its necessary information.

16. \( \frac{(x+1)^2}{16} - \frac{(y-2)^2}{7} = 1 \)  
17. \( x = (y-2)^2 + 3 \)

18. \( \frac{(x-3)^2}{5} + (y + 2)^2 = 1 \)  
19. \( (x - 2)^2 + (y + 3)^2 = 25 \)

Given the equation of a circle, find the center and the radius.

20. \( x^2 + y^2 = 4x \)  
21. \( x^2 + y^2 - 6x + 4y = 0 \)

Given the equation of a parabola, find the axis of symmetry.

22. \( y^2 + 6y + 8x - 7 = 0 \)  
23. \( x^2 = y + 2x \)

Given the equation of an ellipse, find the foci.

24. \( x^2 + 25y^2 = 100 \)  
25. \( 9x^2 + 4y^2 = 36 \)

Given the equation of a hyperbola, find the length of the transverse axis.

26. \( x^2 - 4y^2 - 6x - 16y - 11 = 0 \)  
27. \( y^2 - 2x^2 - 2y + 4x - 5 = 0 \)
Rational Answers

1. \( \frac{2n-3}{5} \)  2. \( \frac{c+2d}{c-3d} \)  3. \( \frac{(x+y)^2}{x^2+xy+y^2} \)  4. \( \frac{a^2-3a+9}{a-3} \)

5. \( \frac{5a-1}{5(a-3)} \)  6. \( \frac{-5x}{x+4} \)

7. Zeros: \( x = \frac{1}{2} \)  3 Domain: \((-\infty, -3) \cup (-3,0) \cup (0,1) \cup (1,\infty)\)

8. Zeros: \( s = \frac{1}{4} \)  -4 Domain: \((-\infty, \frac{1}{2}) \cup (\frac{1}{2}, \infty)\)

9. Zeros: \( z = 2 \) Domain: \((-\infty, -3) \cup (-3,0) \cup (0,3) \cup (3,\infty)\)

10. Zeros: \( x = -3 \) Domain: \((-\infty, \infty)\)

11. \( \frac{8x^2}{15yz} \)

12. \( \frac{5c^{11}}{6a^3} \)

13. \( \frac{rt^3}{5} \)

14. \( \frac{3x-2}{3x+2} \)

15. \( x \)

16. \( \frac{2}{2u+v} \)

17. \( \frac{x^2-7x+14}{(x+2)^2(x-2)} \)

18. \( \frac{4y+5}{y(y+1)(y-1)} \)

19. \( \frac{-1}{x+2} \)

20. \( \frac{1}{y+x} \)

21. \( \frac{t}{t-2} \)

22. \( \frac{1}{(x+y)(x^2+y^2)} \)

23. \( x = \frac{3}{2} \)

24. \( x = 3, -2 \)

25. \( x = 1 \)

26. \( x = -1 \)

27. \( x = \frac{-3\pm\sqrt{5}}{2} \)

28. 0.8 L of 7.5% and 1.0 L of 12%  29. 5:24 pm  30. 2.5 km/h

31. \( VA: x = 3; \ HA: y = 2 \)

32. \( VA: x = 6, -4; \ HA: y = 0 \)

33. \( VA: x = -2; \ HA: y = -1; \ x - int: (3,0); \ y - int: \left(0, \frac{3}{2}\right)\); \( D: (-\infty, -2) \cup (-2, \infty)\); \( R: (-\infty, -1) \cup (-1, \infty)\); \( As \ x \to -\infty, f(x) \to -1 \)  \( As \ x \to \infty, f(x) \to 1 \)

34. \( VA: x = 3; \ HA: y = -2; \ x - int: \left(-\frac{5}{2}, 0\right); \ y - int: \left(0, \frac{5}{3}\right)\); \( D: (-\infty, -2) \cup (-2, \infty)\); \( R: (-\infty, -1) \cup (-1, \infty)\); \( As \ x \to -\infty, f(x) \to -2 \)  \( As \ x \to \infty, f(x) \to 2 \)

35. \( VA: x = \pm 2; \ HA: y = 0; \ x - int: (0,0); \ y - int: (0,0)\); \( D: (-\infty, -2) \cup (-2, \infty)\); \( R: (-\infty, 0) \cup (0, \infty)\); \( As \ x \to -\infty, f(x) \to 0 \)  \( As \ x \to \infty, f(x) \to 0 \)

36. \( VA: x = \pm 3; \ HA: y = 1; \ x - int: (0,0); \ y - int: (0,0)\); \( D: (-\infty, -3) \cup (-3, \infty)\); \( R: (-\infty, 0] \cup (1, \infty)\); \( As \ x \to -\infty, f(x) \to 1 \)  \( As \ x \to \infty, f(x) \to 1 \)

ANSWERS – Trigonometry

1. \( \theta = 670^\circ + 360^\circ n, \) where \( n \) is an integer: \( 310^\circ, -50^\circ \)

2. \( \theta = \frac{13\pi}{8} + 2\pi n, \) where \( n \) is an integer: \( \frac{29\pi}{8}, -\frac{3\pi}{8} \)

3. \( 23.45^\circ \)

4. \( 102^\circ 23' 24'' \)

5. \( 18^\circ < \theta < 36^\circ \)

6. \( 54^\circ < \theta < 72^\circ \)

7. \( \sin \theta = \frac{7}{8}; \ \cos \theta = \frac{\sqrt{15}}{8}; \ \tan \theta = \frac{7\sqrt{15}}{15}; \ \csc \theta = \frac{8}{7}; \ \sec \theta = \frac{8\sqrt{15}}{15}; \ \cot \theta = \frac{\sqrt{15}}{7} \)

8. \( \sin \theta = \frac{-3\sqrt{5}}{7}; \ \cos \theta = \frac{2}{7}; \ \tan \theta = \frac{-3\sqrt{5}}{2}; \ \csc \theta = \frac{-7\sqrt{15}}{15}; \ \sec \theta = \frac{7}{2}; \ \cot \theta = \frac{-2\sqrt{5}}{15} \)

9. \( x = \frac{7}{2} \)

10. \( x = \frac{13\sqrt{3}}{4} \)

11. \( x = \frac{76\sqrt{3}}{3} \)

12. \( x = 24 \)

13. \( x = 4\sqrt{6}, \ y = 4\sqrt{3} \)

14. 859,829,517 feet

15. \( x = 19.075^\circ \)

16. \( x = 75.522^\circ, 75.522^\circ, 28.955^\circ \)

17. Farmers: 41,994 and 51,994 feet from silo. Height: 24.245 feet

18. 1.974 mi

19. \( \frac{4\pi}{9} \)

20. \( 660^\circ \)

21. \( \frac{5\pi}{4} \)

22. \( 405^\circ \)

23. Q2
24. Q2  
25. $\frac{-2\sqrt{3}}{3}$  
26. -1  
27. $-\frac{\sqrt{3}}{2}$  
28. -1  
29. $\sqrt{3}$  
30. $\frac{\sqrt{3}}{2}$  
31. \(\sin 90^\circ = 1 \quad \cos 90^\circ = 0 \quad \tan 90^\circ = \text{undef} \quad \csc 90^\circ = 1 \quad \sec 90^\circ = \text{undef} \quad \cot 90^\circ = 0\)  
\(\sin 180^\circ = 0 \quad \cos 180^\circ = -1 \quad \tan 180^\circ = 0 \quad \csc 180^\circ = \text{undef} \quad \sec 180^\circ = -1 \quad \cot 180^\circ = \text{undef} \)  
\(\sin 270^\circ = -1 \quad \cos 270^\circ = 0 \quad \tan 270^\circ = \text{undef} \quad \csc 270^\circ = -1 \quad \sec 270^\circ = \text{undef} \quad \cot 270^\circ = 0\)  
\(\sin 360^\circ = 0 \quad \cos 360^\circ = 1 \quad \tan 360^\circ = 0 \quad \csc 360^\circ = \text{undef} \quad \sec 360^\circ = 1 \quad \cot 360^\circ = \text{undef} \)  
32. \(\cos 30^\circ\)  
33. \(-\sin 45^\circ\)  
34. \(\cot \theta = -\frac{4}{3}\)  
35. \(x = -\frac{3\pi}{4}, -135^\circ\)  
36-37. Yes, See Work  
38. No Solution  
39. \(B = 32.2^\circ, \ C = 81.8^\circ, \ c = 13.0\)  
40. \(B = 58.1^\circ, \ C = 76.9^\circ, \ c = 20.7 \ \text{OR} \ B = 121.9^\circ, \ C = 13.1^\circ, \ c = 4.8\)  
41. \(A = 60.6^\circ, \ B = 40.8^\circ, \ C = 78.6^\circ\)  
42. \(t = 18.6\)  
43. \(t = 21.7\)  
44. \(49.215 \text{ km}\)  
45. \(35.659^\circ\)  
46. \(32 \text{ hrs. 27 min.}\)  
47. \(s = \frac{5\pi}{2} \approx 7.85 \text{ m}\)  
48. \(A = \frac{3\pi}{2} \approx 4.71 \text{ } \text{mi}^2\)  
49. \(10.83 \text{ mi/hr}\)  
50. Angular: \(9.42 \text{ radians/sec}\) Linear: \(28.27 \text{ ft/sec}\)  
51. Neither  
52. Neither  
53. Even  
54. Odd  
55. \(Amp: 3; \ Period: \frac{2\pi}{3}\)  
56. \(Amp: \frac{1}{2} \text{ with reflection}; \ Period: 4\pi\)  
57. \(Amp: 1; \ Period: \pi; \ Phase: R \frac{\pi}{2}; \ Vertical: \text{Up 1}\)  
58. \(Amp: 2; \ Period: 1; \ Phase: R \frac{\pi}{2}; \ Vertical: \text{Up } \frac{1}{2}\)  
59. \(Amp: \text{Reflected}; \ Period: \pi; \ Vertical: \text{Down 2}\)  
60. \(Amp: -; \ Period: \pi; \ Phase \frac{\pi}{2}\)  
61. \(\frac{\pi}{6}; \ \frac{5\pi}{6}; \ \frac{\pi}{4}; \ \frac{2\pi}{3}\)  
62. \(\frac{5\pi}{6}; \ \frac{\pi}{4}; \ \frac{2\pi}{3}\)  
63. \(0\pi\)  
64. \(0\pi\)  
65. \(0\pi\)  
66. \(0\pi\)  
67. \(\frac{5\pi}{6}; \ \frac{\pi}{4}; \ \frac{2\pi}{3}\)  
68. \(\frac{2\pi}{3}\)  
69. \(\frac{\pi}{2}; \ 70. 1; \ 71. \frac{12}{13}; \ 72. \frac{25}{24}; \ 73. -\frac{\pi}{4}\)  
70. \(\sqrt{3}\)  
71. \(\tan^2 x\)  
72. \(\tan x\)  
73. \(\cot x\)  
74. \(\sec^2 x\)  
75. \(\cos x + \sin x\)  
76. \(2 \sec x\)  
77. \(\cos^2 x\)  
78. \(\sin x \tan x\)  
79. \(-\frac{\sqrt{6}-\sqrt{2}}{4}\)  
80. \(-\frac{\sqrt{6}-\sqrt{2}}{4}\)  
81. \(-\frac{\sqrt{6}-\sqrt{2}}{4}\)  
82. \(-\frac{\sqrt{6}-\sqrt{2}}{4}\)  
83. \(-\frac{\sqrt{6}-\sqrt{2}}{4}\)  
84. \(-\frac{\sqrt{6}-\sqrt{2}}{4}\)  
85. \(-\frac{\sqrt{6}-\sqrt{2}}{4}\)  
86. \(-\frac{\sqrt{6}-\sqrt{2}}{4}\)  
87. \(-\frac{\sqrt{6}-\sqrt{2}}{4}\)  
88. \(-\frac{\sqrt{6}-\sqrt{2}}{4}\)  
89. \(\sqrt{2} + 1\)  
90. \(-\frac{\sqrt{6}-\sqrt{2}}{2}\)  
91. \(\alpha = 39.231^\circ, 140.768^\circ, 219.232^\circ, 320.768^\circ\)  
92. \(x = 1.249, 1.893, 4.391, 5.034\)  
93. \(x = \frac{3\pi}{2} + 2\pi k\)  
94. \(x = \frac{\pi}{4} + 2\pi k; \ \frac{3\pi}{4} + 2\pi k\)  
95. \(x = \frac{\pi}{6} + \pi k; \ \frac{5\pi}{6} + \pi k\)
96. \( x = \pi k; \frac{3\pi}{4} + \pi k \)  
97. \( \alpha = 15^\circ + 180^\circ k; \ 165^\circ + 180^\circ k \)  
98. \( \alpha = 90^\circ + 360^\circ k \)

99. \( \theta = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3} \)  
100. \( \theta = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4} \)  
101. \( x = 0\pi, \pi, \frac{2\pi}{3}, \frac{4\pi}{3} \)  
102. \( x = 0\pi, \pi \)

**ANSWERS – Probability**

1. 1,000  
2. 20  
3. 18  
4. 483,840  
5. 40,320  
6. 56  
7. 35  
8. 720  
9. 120  
10. 60  
11. \( 350C_5 \)  
12. 48  
13. 2,574  
14. 9,979,200  
15. 19,958,400  
16. 3,024  
17. \( \frac{3}{8} \)  
18. \( \frac{3}{8} \)  
19. \( \frac{1}{26} \)  
20. \( \frac{4}{13} \)  
21. \( \frac{3}{4} \)  
22. \( \frac{1}{17} \)  
23. \( \frac{1}{221} \)  
24. \( \frac{25}{102} \)  
25. \( \frac{19}{34} \)  
26. \( \frac{1}{6} \)  
27. \( \frac{1}{3} \)  
28. 3:4  
29. 4:1  
30. 1:14  
31. \( \frac{10}{11} \)  
32. \( \frac{4}{13} \)  
33. \( \frac{8}{11} \)  
34a. \( \frac{1}{22} \)  
34b. \( \frac{125}{1331} \)  
34c. \( \frac{2}{33} \)  
34d. \( \frac{2}{33} \)  
35. \( \frac{3}{29} \)  
36. \( \frac{9}{25} \)

**ANSWERS – Sequences and Series**

1. \( t_n = -7n + 25 \)  
2. \( t_n = 16 \left( \frac{3}{2} \right)^{n-1} \)  
3. \( t_{17} = -71 \)  
4. \( n = 49 \)  
5. \( S_{38} = -3,173 \)  
6. \( t_n = 7n - 2 \)  
7. \( t_n = 6n + 3 \)  
8. 6, 11, 16, 21, 26  
9. \( t_n = \frac{8}{625} (5)^{n-1} \)  
10. \( t_n = 144 \left( \frac{1}{3} \right)^{n-1} \)  
11. \( t_{12} = -512 \)  
12. \( t_{20} = 193.48^\circ \) and \( t_{60} = 2897.32^\circ \) No, the temperature cannot get this high  
13. \( \frac{3,145,725}{4} \)  
14. \( \frac{1}{12} \sqrt{36} \cdot \frac{1}{18} \)  
15. -4, -12, -36, -108, -324, -972  
16. 249,991  
17. 59,040  
18. \( \frac{110}{9} \)  
19. 20  
20. \( \sum_{n=1}^{\infty} \frac{n}{2n+1} \)  
21. \( \sum_{n=1}^{9} 2(3^{n-1}) \)  
22. 28,125  
23. 4,126,500  
24. $99,600  
25. 3,657.62 feet

**ANSWERS – Conics**

1. **Circle** – Center: \((-5,2)\) Radius: 4 Domain: \([-9,-1] \) Range: \([-2,6] \)
2. **Hyperbola** – \( C: (2,1); \ V: (2,2)(2,0); \ F: (2, 1 \pm \sqrt{10}) \) Asy: \( y - 1 = \pm \frac{1}{3} (x - 2) \)  
   \( D: (-\infty, \infty); \ R: (-\infty, 0] \cup [2, \infty) \)
3. **Parabola** – \( V: (-3,-1); \ F: (-1, -1); \ D: x = -5; \ AoS: y = -1; \ D: [-3, \infty); \ R: (-\infty, \infty) \)
4. **Ellipse** – \( C: (-1,2); \ V: (-4,2)(2,2); \ CV: (-1,0)(-1,4); \ F: (-1 \pm \sqrt{5}, 2); \ D: [-4,2]; \ R: [0,4] \)
5. Hyperbola C: (1, -2); V: (-1, -2)(3, -2); F: \((1 \pm \sqrt{13}, -2)\); Asy: \(y + 2 = \pm \frac{3}{2}(x - 1)\); D: \((-\infty, -1] \cup [3, \infty)\); R: \((-\infty, \infty)\)

6. Parabola V: (2, 1); F: \(\left(2, \frac{35}{4}\right)\); Dir: \(y = \frac{3}{4}\); AoS: x = 2; D: \((-\infty, \infty)\); R: [1, \infty)

7. Parabola V: (-3, -2); F: (-6, -2); Dir: x = 0; AoS: y = -2; D: \((-\infty, -3]\); R: \((-\infty, \infty)\)

8. Hyperbola C: (-4, -5); V: (-4, -10)(-4, -1); F: (-4, -10) (-4, 0); Asy: \(y + 5 = \pm \frac{4}{3}(x + 4)\); D: \((-\infty, \infty)\); R: \((-\infty, -9] \cup [-1, \infty)\)

9. Ell C: (4, -2); V: (-2, -2)(10, -2); CV: (4, -2 \pm \sqrt{7}); F: (4 \pm \sqrt{29}, -2); D: [-2, 10]; R: \([-2 - \sqrt{7}, -2 + \sqrt{7}]\)


11. \((x + 2)^2 + (y - 4)^2 = 26\)

12. \((y + 4) = \frac{1}{31}(x + 3)^2\)

13. \((x - 1) = 2(y - 3)^2\)

14. \(\frac{(x-4)^2}{9} + \frac{(y+3)^2}{25} = 1\)

15. \(\frac{(y-5)^2}{4} - \frac{(x+4)^2}{12} = 1\)

16. Hyperbola C: (-1, 2); V: (-5, 2)(3, 2); F: (-1 \pm \sqrt{23}, 2); Asy: \(y - 2 = \pm \frac{\sqrt{7}}{4}(x + 1)\); D: \((-\infty, -5] \cup [3, \infty)\); R: \((-\infty, \infty)\)

17. Parabola V: (3, 2); F: \(\left(\frac{13}{4}, 2\right)\); Dir: x = \(\frac{11}{4}\); AoS: y = 2; D: [3, \infty); R: \((-\infty, \infty)\)

18. Ellipse C: (3, -2); V: (3 \pm \sqrt{5}, -2); CV: (3, -3)(3, -1); F: (1, -2)(5, -2); D: \([3 - \sqrt{5}, 3 + \sqrt{5}]\); R: [-3, -1]


20. Center: (2, 0) Radius: 2

21. Center: (3, -2) Radius: \(\sqrt{3}\)

22. \(y = -3\)

23. \(x = 1\)

24. \((4\sqrt{6}, 0)\)

25. \((0, \pm\sqrt{5})\)

26. Trans Axis: 4

27. Trans Axis: 4