Advanced Functions and Modeling

Practice Exam

Choose the best answer.

1. The main difference between a permutation and a combination is
    a. in a permutation, order matters
    b. in a combination, order matters
    c. there is no difference, the two words have the same definition
    d. to find a combination, we use factorial

2. How many area codes are possible if an area code is three digits long, the first digit must be a number 2 through 9, the second number must be a one or zero, and the 3rd number can be any digit 0-9?
    a. 600
    b. 160
    c. 20
    d. 126

3. A North Carolina general license plate for an automobile consists of a total of three letters and four numbers. How many possible ways can a NC license plate be created?
    a. 113
    b. 2,152800
    c. 456,976,000
    d. 175,760,000

4. If you flip two coins, what is the probability of flipping 2 heads?
    a. 25%
    b. 50%
    c. 75%
    d. 100%

5. If you flip two coins, what is the probability of flipping 1 head and 1 tail?
    a. 25%
    b. 50%
    c. 75%
    d. 100%

6. In a standard deck of 52 cards, what is the probability you will select a King and then a 2 of hearts if there is no replacement?

a. 9.65%
b. 9.62%
c. 0.1479%
d. 0.1508%

Use for Questions 7 – 9

The chart below shows the eight states in the United States with the greatest number of hazardous waste sites.

State	Total
New Jersey	110
Pennsylvania	100
California	96
New York	80
Michigan	74
Florida	55
Washington	47
Illinois	41

7. If **one state** from the list is selected at random, determine the probability the state has exactly 80 hazardous waste sites.

a. 13.27%
b. 50%
c. 27.51%
d. 12.5%

8. If **one state** from the list is selected at random, determine the probability the state has greater than 80 hazardous waste sites.

a. 50%
b. 37.5%
c. 21.5%
d. 12.5%

9. If **one site** from the list is selected at random, determine the probability the site is from Florida.

a. 9.12%
b. 12.5%
c. 0.17%
d. 27.5%

Use for Questions 10 – 13:

A basketball player is deemed a 60% shooter. Assuming he or she will take 2 free throws, answer the following questions:

10. What is the probability the shooter will make zero free throws?
    a. 0%
    b. 16%
    c. 36%
    d. 50%
    e. 100%

11. What is the probability the shooter will make one of the two free throws?
    a. 24%
    b. 36%
    c. 48%
    d. 60%
    e. 100%

12. What is the probability the shooter will make both free throws?
    a. 24%
    b. 36%
    c. 48%
    d. 60%
    e. 100%

13. What is the average point total per trip to the free throw line?
    a. 2
    b. 1.2
    c. .96
    d. .75
    e. 0

14. How many ways can you arrange a class of 21 students into 4 groups?
    a. 84
    b. 25
    c. 143,640
    d. 5,985

15. How many ways can you arrange a baseball team with 12 players into a line-up consisting of 9 players?

a. 220
b. 79,833,600
c. 108
d. 1

16. If using a standard 52 card deck, what is the probability you draw a 2 or a heart?

a. 30.77%
b. 1.76%
c. 26.92%
d. 3.845%

17. An experiment consists of tossing a coin twice. Find the sample space. (head = h, tails = t)

a. hh , ht, th, tt
b. hh, th, tt
c. hh, ht, tt
d. hh, hh, ht, th, tt, tt

18. A jar contains six red marbles numbered 1 to 6 and ten blue marbles numbered 1 to 10. A marble is drawn at random from the jar. Find the probability that the marble is odd-numbered.

a. 66.6%
b. 50%
c. 75%
d. 33.3%

19. A monkey is trained to arrange wooden blocks in a straight line. He is then given 11 blocks showing the letters A, B, B, I, I, L, O, P, R, T, Y. What is the probability that the monkey will arrange the blocks to spell the word PROBABILITY?

a. 1 out of 39,916,800
b. 1 out of 66
c. 4 out of 39,916,800
d. 4 out of 66

20. A state lottery allows players to choose 6 numbers from the digits 0 – 46. There are 9,366,819 different combinations for tickets. If a player purchases each ticket for a dollar, they are guaranteed to win. If they win, the jackpot is 70 million dollars. Why doesn't this person purchase every combination?
    a. Under state law, it is illegal to purchase every combination.
    b. They are afraid they will lose their tickets.
    c. The person will actually need to buy 6.7 trillion tickets.
    d. No machine can produce millions of tickets in enough time before the drawing.

21. The correlation coefficient is the only way to determine the 'goodness of a line'.
    a. true
    b. false

22. A residual value is the distance from the actual data point to the line of best fit.
    a. true
    b. false

23. A residual graph that has no pattern indicates a bad prediction equation.
    a. true
    b. false

Use for Questions 24-27.

Answer the following questions based on this fictional data:

Hours of Study	Test Score
0.25	70
0.5	76
0.75	79
1.00	83
1.25	87
1.50	92
1.75	96

24. The model for this data is:
    a. $r = 0.99785$
    b. $y = .25x + 96$
    c. $y = 15x + 70$
    d. $y = 16.057x + 66.43$

25. What can we predict a person's test score to be if they studied for a third of an hour?

a. 117 %
b. 71.486 %
c. 72.048 %
d. 73 %

26. How much time did a person study if they received a 96.771?

a. 1.8 hours
b. 1.6 hours
a. 1.4 hours
b. 1.2 hours

27. The graph of the residuals for the table can be described as:

a. Showing a pattern
b. Five residuals near zero, two residuals not as close to zero
c. Showing no pattern
d. Both b and c
e. None of the above

28. Which of the following describes a situation that has a linear relationship?

a. $1000 in a savings account that accrues interest twice a month.
b. An hourly paying job.
c. The population of a new nation.
d. The popularity of a movie over 10 years

29. To determine if a model of best fit is 'good', find

a. the 'r' value
b. The graph and sum of the residuals
c. Look at the graph to see if the line fits
d. A and B
e. All of the above

30. Describe the transformation of $f(x) = e^{-x}$.

a. shift left 1
b. flipped over *y* axis
c. flipped over *x* axis
d. shift right 1

31. Describe the transformation of $f(t) = -(e^{t+3})$

a. shift left 3
b. shift up 3
c. flipped over *x* axis, shift up 3
d. flipped over *x* axis, shift left 3

32. State the domain of $f(x) = 3 - 3^{x+2}$ using interval notation.

a.
b.
c.
d.

33. State the range of $f(x) = -(2^x)$ using interval notation.

a.
b.
c.
d.

34. State the *y*-intercept of $f(x) = e^{x+2} + 3$

a. (0, 10.389)
b. (0, 6)
c. none
d. (0, 3)

35. Solve $3^x = 33$

a. *x* = 10
b. *x* = 69.165
c. *x* = 3.183
d. *x* = 11

36. A model for the number of people N at Athens Drive who have heard a rumor is $N = P(1 - e^{-0.15d})$. *P* stands for population and *d* stands for days. Using the population of Athens Drive (1700), how many people have not heard the rumor after 5 days?

a. About 897
b. About 804
c. About 908
d. About 1051

Use for Questions 37 – 40:

Use the following information to answer the following questions:

Year	***$$$$$***
1988	20,000
1989	21,516
1990	23,355
1991	24,885
1992	27,434
1993	30,053
1994	32,622

37. What model fits this data best?
    a. linear
    b. quadratic
    c. power
    d. exponential

38. Find the prediction model for this data.
    a. $2.9(1.09)^x$
    b. 3.161^x
    c. 0.99865
    d.

39. Predict the value in 1996 using the table.
    a. $38,204
    b. $34, 264
    c. $41,471
    d. cannot be predicted

40. What year will this person have $86,776?
    a. 2001
    b. 2003
    c. 2006
    d. 2010

41. The inverse of an Exponential Function is a Logarithmic function.
    a. true
    b. false

42. The base of a logarithmic function is sometimes negative.
    a. true
    b. false

43. Find the vertex of $-2x^2 + x - 3 = f(x)$
    a. (0, -3)
    b. 0.2499
    c. -2.875
    d. (0.2499, -2.875)

44. Find the root(s) of $3x^2 + x - 4 = f(x)$.
    a. $-1\frac{1}{3}$
    b. 1
    c. $-1\frac{1}{3}$ and 1
    d. no real roots

Use for questions 45 – 47.

A projectile is fired at an inclination of 45 degrees to the horizontal, with a muzzle velocity of 200 feet per second. The height *h* of the projectile is given by: $h(x) = \frac{-32x^2}{(200)^2} + x$, where *x* is the horizontal distance of the projectile from the firing point. (*window hint: 0<x<1500, 0<y<400)*.

45. What is the highest point the projectile will reach?
    a. 312.5 feet
    b. 625 feet
    c. 312.5 feet/sec
    d. 625 feet/sec

46. A person is standing 1250 feet from the firing point. Will this person be hit by the projectile?
    a. yes
    b. no

47. When the height of the projectile is 60 feet above the ground, how far has it traveled horizontally?

a. 57.12 feet
b. 63.25 feet
c. 1186.75 feet
d. b and c

48. What is the largest rectangular area that can be enclosed with 800 feet of fencing?

a. 200 square feet
b. 1600 square feet
c. 40,000 square feet
d. 640,000 square feet

Use for Questions 49 – 54.

Describe the polynomial function:

$f(t) = t^3 - 2t^2 - 19t - 10$ (*window hint: -10<x<10, -100<x<20)*

49. What is the domain of the function using interval notation?

a.
b.
c.
d. cannot determine domain

50. What is the range of the function using interval notation?

a.
b.
c.
d. cannot determine the range

51. What are the factors of the function?

a. $(x + 3.09)$, $(x + 0.570)$, $(x + 5.665)$
b. $(x - 3.09)$, $(x - 0.570)$, $(x - 5.665)$
c. $(x + 3.09)$, $(x + 0.570)$, $(x - 5.665)$
d. $(x - 3.09)$, $(x - 0.570)$, $(x + 5.665)$

52. The local max(s) is/are:

a. (3.27, -58.55)
b. -1.936
c. 12.031
d. (-1.936, 12.031)

53. The local min(s) is/are:
    a. (3.27, -58.55)
    b. 3.27
    c. -58.55
    d. (-1.936, 12.031)

54. If asked to solve for *x*, how many solutions would you anticipate?
    a. 0
    b. 1
    c. 2
    d. 3

Use for 55 - 57.

The data below represents the enrollment in all public schools for the academic years starting in 1972 – 1973.

Year	Enrollment
1972 – 1973	42.7
1973 – 1974	41.578
1974 – 1975	40.686
1975 – 1976	40.016
1976 – 1977	39.561
1977 – 1978	39.313
1978 – 1979	39.263
1979 – 1980	39.405
1980 – 1981	39.73

55. Find the model of best fit if *x* is the years since 1972 – 1973:
    a.
    b.
    c.
    d. Not enough information

56. Out of the following, what should one consider when picking the above model?
    a. Which model looks like it fits the graph the best
    b. the best 'r' value
    c. the residual graph
    d. all of the above

57. When can we predict the enrollment was the lowest in our data?
    a. about 5.7 years after the start of the data
    b. about 39 years after the start of the data
    c. the first year the data was collected
    d. the last year the data was collected

Questions 58 – 61.

Determine if the following situation is precise, accurate, both, or neither.

58. A baseball player strikes out 3 times in a row.
    a. precise
    b. accurate
    c. both
    d. neither

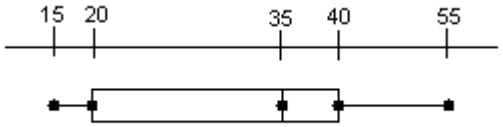
59. A baseball player hits 3 homeruns in a row to the same fan in the outfield.
    a. precise
    b. accurate
    c. both
    d. neither

60. The weatherman predicts four days of rain. It never rains.
    a. precise
    b. accurate
    c. both
    d. neither

61. The last 3 quiz grades for a student are 82, 81, 82. They hope to make a 93 on their quiz average.
    a. precise
    b. accurate
    c. both
    d. neither

Questions 62 – 66.

Weekly Mileage Totals, 24 Runners



62. What is the highest weekly total?
    a. 35
    b. 40
    c. 55
    d. 20

63. What is the lowest weekly total?
    a. 15
    b. 20
    c. 35
    d. 40

64. What is the median weekly total?
    a. 20
    b. 35
    c. 40
    d. 55

65. How many runners run less than 20 miles a week?
    a. 5
    b. 6
    c. 15
    d. 20

66. Name any outliers.
    a. 15
    b. 55
    c. 15 and 55
    d. there are no outliers

Questions 67 – 73.

Use the fictional data to answer the following questions:
3.3, 4.1, 4.1, 4.2, 4.4, 4.4, 4.6, 4.6, 4.6, 4.6, 4.8, 5.0, 5.0, 5.1, 5.3, 5.3, 5.4, 5.5, 6.0

67. What is the mean of the data?
    a. 3.3
    b. 4.6
    c. 4.75
    d. 6.0

68. What is the mode of the data?
    a. 4.6
    b. 4.53
    c. 3.3
    d. 6.0

69. What is the median of the data?
    a. 4.6
    b. 4.75
    c. 3.3
    d. 6.0

70. What is the range of the data?
    a. 4.6
    b. 4.53
    c. 2.7
    d. 3.3

71. What is the lower quartile of the data?
    a. 4.4
    b. 4.6
    c. 5.3
    d. 6.0

72. What is the upper quartile of the data?
    a. 4.4
    b. 4.6
    c. 5.3
    d. 6.0

73. What is the Inner Quartile Range?
    a. 9
    b. 1.5
    c. 13.5
    d. not given

Questions 74 - 78

Answer the following questions for the function $y = \left(\frac{5}{2}\right)^x$.

74. Is the function increasing, decreasing, both, or neither?
    a. increasing
    b. decreasing
    c. both
    d. neither

75. What is the y – intercept?
    a. 0
    b. 1
    c. all real numbers greater than 0
    d. all real numbers

76. What is the x – intercept?
    a. 1
    b. 0
    c. all real numbers
    d. none of the above

77. What is the domain of the function?
    a. all real numbers
    b. all real numbers greater than 0
    c. there is no domain
    d. none of the above

78. What is the range of the function?
    a. all real numbers less than 0
    b. all real numbers
    c. there is no range
    d. none of the above

79. Solve $2^x = 3$

a. 1.5
b. 1.58496
c. 0.5
d. -1.58496

80. Write as an exponential function: $\log_x 34 = 5$

a. $x^5 = 34$
b. $5^x = 34$
c. $34^x = 5$
d.

81. A bank is offering 4.32% interest, compounded continuously. If you invest $2000 in the account, how much money will you have in 3 years?

a. $850,132,229.60
b. $7309.30
c. $2276.75
d. $704.58

82. A bank is offering 4.32% interest, compounded monthly. If you invest $1500 in the account, how much money will you have in 4 years?

a. $1781.52
b. $1500.00
c. $1782.39
d. $3.85 billion

83. How much time would it take to double your money if you put your money in a savings account that is compounded bi-yearly at 2.34%?

a. 29.79 years
b. 0.44 year
c. 3.13 years
d. 0.148 year
e. 0.988 year

84. If $f(x) = \begin{cases} 3x+1, x<0 \\ 2x-3, x=0 \\ x^2 - x, x>0 \end{cases}$, what is $f(4)$?

a. 13
b. 5
c. 12
d. 4

85. If $f(x)=\begin{cases}3x+1, x<0\\ 2x-3,\ x=0\\ x^2-x,\ x>0\end{cases}$, what is f (-4)?

a. -11
b. -13
c. 12
d. 5

86. If $f(x)=\begin{cases}[x]+2, x\geq 4\\ [x]-1,\ 0<x<4\\ [x]+1,\ x\leq 0\end{cases}$, what is f (5.5)?

a. 5
b. 6
c. 7
d. 8

87. If $f(x)=\begin{cases}[x]+2, x\geq 4\\ [x]-1,\ 0<x<4\\ [x]+1,\ x\leq 0\end{cases}$, what is f (-2.7)?

a. -2
b. -1
c. 0
d. -1.7

88. If $f(x)=\begin{cases}[x]+2, x\geq 4\\ [x]-1,\ 0<x<4\\ [x]+1,\ x\leq 0\end{cases}$, what is f (1.245)?

a. 0.245
b. 0
c. 3
d. 1

89. For every *x*, there is only one *y*. This is a common definition of a(n):

a. rational number
b. function
c. absolute value
d. model

90. This can predict the future of a collection of data.
    a. a model
    b. a residual
    c. 'r' value
    d. sum of residuals

91. The phase shift for the function $y = \sin(x - \frac{\pi}{4}) + 2$ is
    a. up 2
    b. down 2
    c. left $\frac{\pi}{4}$
    d. right $\frac{\pi}{4}$

92. The vertical shift for the function $y = -2\cos(x + \pi) - 2$ is
    a. up 2
    b. down 2
    c. left π
    d. right π

93. The period for the function $y = 2\cos(2x) + 2$ is
    a. 2π
    b. π
    c. $\frac{\pi}{2}$
    d. $\frac{\pi}{4}$

94. The amplitude for the function $y = -\frac{1}{2}\sin x + 2$ is
    a. $-\frac{1}{2}$
    b. $\frac{1}{2}$
    c. 2
    d. 1

95. From one point on the ground, the angle of elevation of the peak of a mountain is 10.38 degrees, and from a point 15,860 ft closer to the mountain, the angle of elevation is 14.67 degrees. Find the height of the mountain.

a. 10,741 ft
b. 2,671 ft
c. 9674 ft
d. Answer not given

96. Given angle C to be 90° and angle B to be 29° and length of side *c* is 14 units, find the length of side *a.*

a. 6.8
b. 61
c. 14
d. 12

97. Find the Cosecant of a 210° angle.

a. $-\frac{1}{2}$
b. -2
c. $-\sqrt{3}$
d. $\sqrt{3}$

98. Find the exact value for the cosine function of the angle θ in standard position if the point (3,4) is on the terminal side of the angle.

a. $\frac{4}{5}$
b. $\frac{3}{5}$
c. $\frac{5}{4}$
d. $\frac{5}{3}$

99. An angle is rotated clockwise $\frac{1}{4}$ th a rotation. Find the degree measure of the angle.

a. -180°
b. 90°
c. 270°
d. -90°

100. Which of the following angles is coterminal to an angle measuring -100°?

a. 260°
b. 0°
c. -400°
d. 200°