

1) How many different outcomes can a race with 9 runners have, assuming there is no tie?

$$9! \quad 9P_9 \quad \underline{9} \cdot \underline{8} \cdot \underline{7} \cdot \underline{6} \cdot \underline{5} \cdot \underline{4} \cdot \underline{3} \cdot \underline{2} \cdot \underline{1} \quad \underline{362880}$$

2) In a certain state, automobile license plates display four letters followed by two digits. How many such plates are possible if repetition of both letters and numbers is allowed?

$$\underline{26} \quad \underline{26} \quad \underline{26} \quad \underline{26} \quad \underline{10} \quad \underline{10} = 45697600$$

3) Find the number of distinct arrangements of the letters: MINIMUM

$$\frac{7!}{(3! 2!)} = 420$$

4) In how many ways can first, second, and third prizes be awarded in a contests with 28 contestants?

$$\underline{28} \quad \underline{27} \quad \underline{26} \quad 28P_3 = 19656$$

5) How many different 4-card hands can be selected from a deck of 26 cards?

$$\frac{26}{4} \frac{25}{3} \frac{24}{2} \frac{23}{1} = 26C_4 = 14950$$

6) Frank wins \$12 if a die roll shows 4, and he loses \$1 otherwise. Find the expected value of the game.

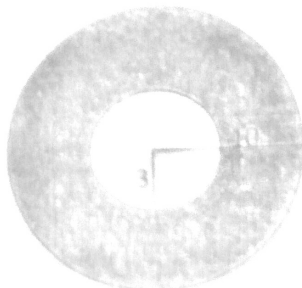
$$\frac{1}{6} \cdot 12 + \frac{5}{6} \cdot -1 = \$1.17$$

7) You plan to invest in a start up business. There is a 40% chance that you will lose \$25,000, a 30% chance that you will break even, and a 30% chance that you will earn \$65,000. Based solely on this information, determine the expected value. Should you or should you not invest in the startup business?

$$.40(-25000) + .30(65000) = 9500$$

Yes

8) If a point is randomly selected from the points inside the circle, find the probability that the point is in the shaded region given that the radius of the larger circle is 10.



B-L

$$\text{Big: } \pi \cdot 10^2 = 100\pi$$

$$\text{L: } \pi \cdot 3^2 = 9\pi$$

$$\text{Shaded} = 100\pi - 9\pi = 91\pi$$

$$P(\text{shaded}) = \frac{91\pi}{100\pi} = \frac{91}{100}$$

$$(a+b)^5 = a^5 b^0 \quad a^4 b^1 \quad a^3 b^2$$

9) Expand $(x - 2y)^5$ using the Binomial Theorem.

$$C_0(x)^5(-2y)^0 + C_1 x^4(-2y)^1 + C_2 x^3(-2y)^2 + C_3 x^2(-2y)^3 + C_4 x^1(-2y)^4 + C_5 x^0(-2y)^5$$

$$x^5 + 5x^4(-2y) + 10x^3(4y^2) + 10x^2(-8y^3) + 5x(16y^4) + 1(-32y^5)$$

10) Use the Binomial Theorem to find the fifth term of $(2x + y)^{13}$.

$$x^5 - 10x^4y + 40x^3y^2 - 80x^2y^3 + 80xy^4 - 32y^5$$

$${}_{13}C_4 (2x)^9 (y^4)$$

$$715 (512x^9) y^4$$

$$366080 x^9 y^4$$

11) Classify each of the following as categorical, numerical/discrete, or numerical/continuous.

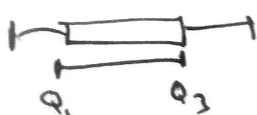
- a. Amount of time spent working on homework. *Num/cont*
- b. The number of A's on the AFM Final Exam. *Num/Disc.*
- c. Colors of crayons made by Crayola. *Cat*

12) Determine the mean, median, and mode of the data below.

72	81	24	65	83	27	39	82
34	47	82	33	29	41	63	50

Mean = 53.25
 Median = 48.5
 Mode = 82

13) What determines the length of the box in a box and whisker plot? The length of the whiskers?

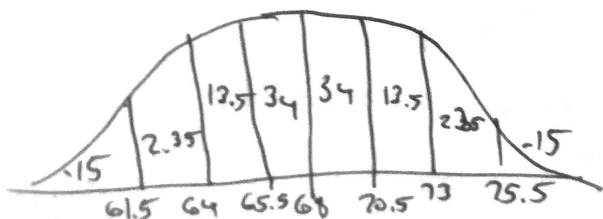


IQR length of box Range

14) Describe the shape of the plot of a normal distribution.



15) In a certain community, the heights of all 18-year-olds have a normal distribution with mean 68 in. and standard deviation of 2.5 in. Predict the percent of 18-year-olds taller than 73 in.



$$2.35 + .15$$

$$2.5\%$$

16) What does it mean if the shape of a histogram is skewed positively? Skewed negatively? Symmetric?

Skewed pos: tail rt \rightarrow extreme highs
 neg: tail left \rightarrow extreme low values

Symmetric: No extremes on only side

17) The function $m(x) = -0.287x^3 + 8.8x^2 - 59.843x + 220.7$ describes the incidence of measles (per 100,000) for the period 1955-1975 ($x = 0$ for 1955). If the function continues to model the disease beyond 1975, when did the incidence of measles reach its maximum? When did the incidence of measles approximate zero?

when 16.1 \rightarrow 1971 zero when: 23 \rightarrow 1978
 how many: 340

18) In 2000, Mary was hired by an advertising agency at a salary of \$52,000 per year. By 2005, her annual salary has increased to \$69,500. Assume her salary increases linearly. What does the slope represent? What was her salary in the year 2009?

$(0, 52000)$ Avg yearly salary increase
 $(5, 69,500)$ $y = 3500x + 52000$
 $y = 3500 \cdot 9 + 52000 = 83500$

19) You take out a \$12,000 loan at 4.25% interest compounded continuously to buy a new car. If it takes you four years to pay off the loan, how much do you spend over the life of the loan?

$$12000 e^{(0.0425 \cdot 4)} = \$14223.66$$

20) When hurricane Fran hit North Carolina on the evening of September 15, 1996, over one million homes and businesses were left without power. Repair crews began immediately restoring electrical service.

	Date	Homes without Power
1	Sept. 6	1,159,000
2	Sept. 7	804,000
3	Sept. 8	515,000
4	Sept. 9	340,500
5	Sept. 10	195,200
6	Sept. 11	136,300
7	Sept. 12	77,000
8	Sept. 13	37,600

Find the exponential regression model that fits this data. In order for your data to make sense, use 1 for September 6th, 2 for September 7th, etc.

$$y = 2110747.65 (.619)^x$$

- 21) When laboratory rats are exposed to asbestos fibers, some of them develop lung tumors. The following table lists the results of several such experiments by different scientists.

Asbestos Exposure (fibers/mL)	% that develop lung tumors
50	3
400	8
500	6
900	16
1100	29
1600	48
1800	41
2000	36
3000	58

$$y = .02x + 1.65$$

Find the regression line for the data. Use your model to estimate the percent that develop lung tumors if the asbestos level is 22 fibers/mL.

$$.02(22) + 1.65 = 2.0997\%$$

- 22) Bill and Ted leave Raleigh at 2:30 PM and drive at a constant speed west along highway I-40. They pass Asheville, 275 miles from Raleigh, at 6:48 PM. Find the slope of the regression line.

Leave (0, 0)

Asheville (4.3, 275)

6:48 2:30

6:48
- 2:30

4:18

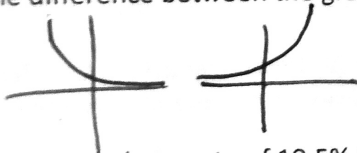
4 $\frac{18}{60}$
4.3

63.95 mph

- 23) Find the value of y when $x = 6$ given that $y = 12(3.8)^x$.

$$12(3.8)^6$$

- 24) Describe the difference between the graph of $y = (\frac{1}{4})^x$ and $y = 4^x$.



decay Growth

- 25) If \$8,000 is borrowed at a rate of 10.5% interest per year, find the amount of the investment compounded quarterly, at the end of 11 years.

$$A = P(1 + \frac{r}{n})^{nt} \quad 8000(1 + \frac{.105}{4})^{4 \cdot 11} = 25016.67$$

- 26) Express the following equation in exponential form: $\ln x = 17$

$$e^{17} = x$$

- 27) Evaluate the expression $\log_5 625$.

$$\frac{\log 625}{\log 5} = 4$$

- 28) Use the Law of Logarithms to rewrite the expression in a form with no products, quotients, or powers.

$$\log ab = \log a + \log b \quad \log_3(x^2 y^3 \sqrt{z})$$

$$\log a^b = b \log a \quad \log_3 x^2 + \log_3 y^3 + \log_3 z^{1/2}$$

$$2 \log_3 x + 3 \log_3 y + \frac{1}{2} \log_3 z$$

29) Find the solution of the equation correct to four decimal places.

$$e^{2-3x} = 7$$

$$\ln 7 = 2 - 3x$$

$$-2 \quad -2$$

$$\frac{(\ln 7) - 2}{-3} = \frac{-3x}{-3}$$

$$x = \frac{\ln 7 - 2}{-3}$$

30) Interpret the graph of the polynomial function $g(x) = x^4 + 3x^3 - 9x^2 - 27x$:

- a. The degree of $g(x)$ is 4.
- b. The leading coefficient of $g(x)$ is: Positive or Negative
- c. The real zeros of $g(x)$ are: 0, -3, -3, 3
- d. The maximum number of turns for the graph of $g(x)$ is 3.
- e. The function in factored form is $x(x+3)(x+3)(x-3)$.

$$x(x^3 + 3x^2 - 9x - 27)$$

$$x(x^2(x+3) - 9(x+3))$$

$$x(x+3)(x^2 - 9)$$

$$x(x+3)(x+3)(x-3)$$

31) Using the method of undetermined coefficients, write the polynomial that contains the following points:

$(-1, -6), (1, 18), (-2, -36), (3, 194)$

32) Without looking at the graph of $f(x) = -x^4(x-1)^2(x+3)^2$, identify:

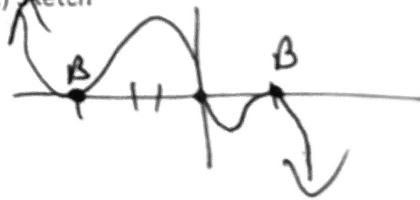
a) Degree of polynomial

5

b) Real Zeros

0, 1, 1, -3, -3

c) Sketch



d) Right end behavior

down

e) Left end behavior

odd up

33) If $f(x) = \begin{cases} -3-x & \text{if } x \leq 0 \\ 1 & \text{if } 0 < x < 1 \\ x^2 & \text{if } x \geq 1 \end{cases}$ then $f(5) = \frac{25}{5^2}$ $f(-2) = \frac{-1}{-3-2}$ and $f(0.387) = 1$

34) In function notation, $y = f(x)$, what is the independent variable? The dependent variable?

x

y

35) Find all solutions to the system of equations: $y = x^2 - 4x + 3$
 $3x - y = 7$

$$3x - (x^2 - 4x + 3) = 7$$

$$3x - x^2 + 4x - 3 = 7$$

$$-x^2 + 7x - 3 = 7$$

$$-x^2 + 7x - 10 = 0$$

$$x^2 - 7x + 10 = 0$$

$$(x-5)(x-2) = 0$$

$$x=5 \quad x=2$$

$$15 - y = 7$$

$$-y = -8$$

$$y = 8$$

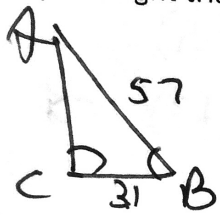
$$36 - y = 7$$

$$-y = -1$$

$$y = 1$$

$$(5, 8) \quad (2, -1)$$

36) In a right triangle ABC, where $C = 90^\circ$, $a = 31$ and $c = 57$, find angle B.

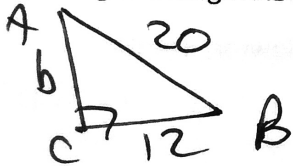


SOHCAHTOA

$$\cos B = \frac{31}{57}$$

$$\cos^{-1} \frac{31}{57} = B \approx 57.05^\circ$$

37) In right triangle ABC, where C is a right angle, $a = 12$ and $c = 20$. Find b.



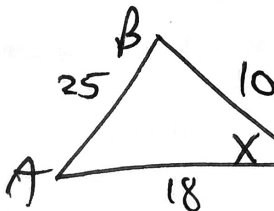
$$12^2 + b^2 = 20^2$$

$$b = 16$$

$$144 + b^2 = 400$$

$$b^2 = 256$$

38) Use the law of Sines or Law of Cosines to find the value of the largest angle in triangle ABC if $a = 10$, $b = 18$, and $c = 25$.



$$c^2 = a^2 + b^2 - 2ab \cos C$$

$$25^2 = 10^2 + 18^2 - 2 \cdot 10 \cdot 18 \cos C$$

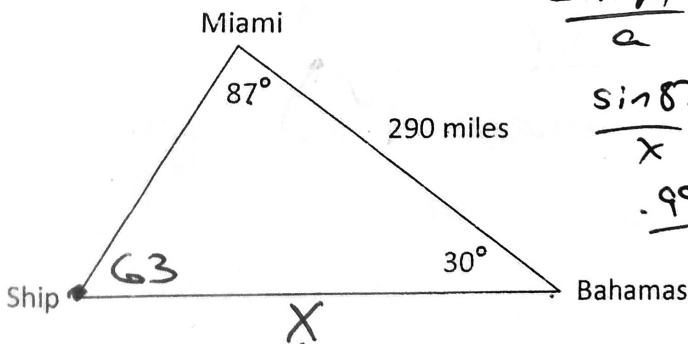
$$625 = 100 + 324 - 360 \cos C$$

$$201 = -360 \cos C$$

$$\cos C = -\frac{201}{360}$$

$$\approx 124^\circ$$

39) A cruise ship leaves dock in Miami on a 290 mile trip to the Bahamas. After traveling for a while, the captain realizes that the ship is heading in the wrong direction. How far is the cruise ship from its destination?



$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

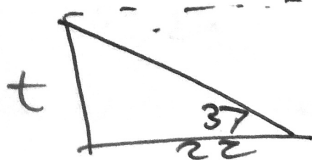
$$\frac{\sin 87}{x} = \frac{\sin 63}{290}$$

$$\frac{.9986}{x} = \frac{.8910}{290}$$

$$.8910x = 289.594$$

$$x \approx 325 \text{ miles}$$

40) A tree casts a shadow of 22 feet when the angle of elevation of the sun is 37° . Find the height of the tree to the nearest tenth of a foot.



$$\tan 37 = \frac{t}{22}$$

$$22 \tan 37 = t$$

$$16.58$$

41) Find a positive and negative angle conterminal with 512° .

$$512 + 360 = 872$$

$$512 - 360 = 152$$

$$152 - 360 = -208$$

42) Convert 84° to radians in terms of π .

$$\frac{\theta}{d} = \frac{\pi}{180}$$

$$\frac{\theta}{84} = \frac{\pi}{180}$$

$$\theta = \frac{7\pi}{15}$$

43) Convert $\frac{17\pi}{5}$ to degrees.

$$\frac{17\pi/5}{d} = \frac{\pi}{180}$$

$$d = 612^\circ$$

44) Find an angle between 0 and 2π that is coterminal to $-\frac{15\pi}{4}$.

$$+2\pi$$

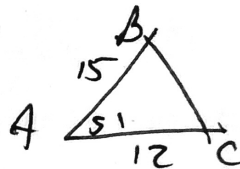
45) Which angle is described by the ordered pair $(-\frac{1}{2}, \frac{\sqrt{3}}{2})$?

unit circle

$$120^\circ$$

46) Find the area of triangle ABC if $A = 51^\circ$, $b = 12$, and $c = 15$.

$$A = \frac{1}{2} ab \sin C$$



$$\frac{1}{2} \cdot 15 \cdot 12 \sin 51$$

47) Find the ninth term of the geometric sequence 11, -44, 176, ...

$$a b^{n-1} \quad a_n = 11(-4)^{n-1}$$

48) Find the sum of the infinite series $\frac{9}{2}, -\frac{9}{4}, \frac{9}{8}, -\frac{9}{16}, \dots$ or state that the sum does not exist.

$$r = -\frac{1}{2}$$

$$|r| < 1$$

$$\frac{a_1}{1-r} = \frac{9/2}{1-(-1/2)} = 3$$

49) Find the sum of the first 20 terms of the series 19, 11, 3, -5, ...

$$\frac{n(a_1 + a_n)}{2}$$

$$a_{20} = 19 + (20-1)(-8) = -133$$

$$\frac{20(19 + -133)}{2}$$

50) Find the first 4 terms if $a_n = \frac{n(n+2)}{2}$.

$$\frac{1(1+2)}{2}, \frac{2(2+2)}{2}, \frac{3(3+2)}{2}, \frac{4(4+2)}{2}$$

51) Write as an indicated sum:

$$\sum_{i=1}^4 (2i^2 - 1)$$

$$2(1)^2 - 1 + 2(2)^2 - 1 + 2(3)^2 - 1 + 2(4)^2 - 1$$

$$1 + 7 + 17 + 31$$

$$56$$