

1. Write each number in scientific notation.

$$\underline{7521.03} = 7.52103 \times 10^3$$

$$\underline{0.003521} = 3.521 \times 10^{-3}$$

2. Put the following numbers in order from least to greatest.

$$\underline{3.14 \times 10^{-4}} \\ 0.000314$$

$$0.00213$$

$$\underline{23.7 \times 10^{-5}} \\ 0.000237$$

$$0.00001$$

$$\underline{0.003 \times 10^4} \\ 30$$

LEAST:  $0.00001, 0.000237, 0.000314, 0.00213, 30$

3. Last year a certain coat cost \$360, but the price has gone up 15% since then. What is the price now?

- (a) \$306.00  
 (b) \$375.00  
 (c) \$414.00  
 (d) \$666.00

$$\begin{aligned} \text{RETAIL PRICE} &= \text{WHOLESALE PRICE} + \text{MARKUP} \\ &= \$360 + 15\%(\$360) \\ &= \$360 + 0.15(\$360) \\ &= \$360 + \$54 = \$414 \end{aligned}$$

4. An item in a store was marked down 25%. If its sale price was \$54.54, what was its original price, to the nearest cent?

- (a) \$79.54  
 (b) \$72.72  
 (c) \$95.45  
 (d) \$68.18

$$\begin{aligned} \text{SALES PRICE} &= \text{RETAIL PRICE} - \text{DISCOUNT} \\ \$54.54 &= X - 25\%(X) \\ \$54.54 &= 1X - 0.25(X) \\ \$54.54 &= 0.75(X) \\ \hline 0.75 & \quad 0.75 \end{aligned}$$

$$\$72.72 = X$$

5. Of the equations listed below, which has a graph that is a parabola opening up?

(a)  $y = 2 - 3x$  ← LINE (DECREASES)

(b)  $y = 2 - 3x^2$  ← PARABOLA (DOWN)

(c)  $y = 3x^2 - 2$

(d)  $y = 3x - 2$  ← LINE (INCREASE)

6. John has been keeping careful track of the amount of lemonade he sells at his lemonade stand, and has determined that if he sees  $n$  customers in a day, then he sells

$$L = 0.28n$$

↖ SLOPE

gallons of lemonade that day. What is the meaning of slope in John's equation?

(a) For each extra customer, John sells 0.28 more gallons of lemonade.

(b) For every 0.28 customers, John sells an extra gallon of lemonade.

(c) The ratio of lemonade to customers is 0.28:1.

(d) John is not selling any lemonade.

7. The vertex of the parabola  $y = 8x - 2x^2$  is at

(a)  $(-2, -8)$

(b)  $(2, -8)$  (c)

$(-2, 4)$  (d)

(2, 8)

$$y = -2x^2 + 8x$$

X-COORDINATE:  $-\frac{b}{2a} = \frac{-8}{2(-2)} = \frac{-8}{-4} = 2$

Y-COORDINATE:  $-2(2)^2 + 8(2)$   
 $= -2(4) + 16 = -8 + 16 = 8$

8. Suppose that a kicked football follows a path given by  $y = -0.1x^2 + 1.6x$ , where  $x$  is the distance in feet from where the ball was kicked and  $y$  is the height of the ball above the ground, also in feet. What is the maximum height the ball reaches?

(a) 8 feet

(b) 6.4 feet

(c) 1.7 feet

(d) 64 feet

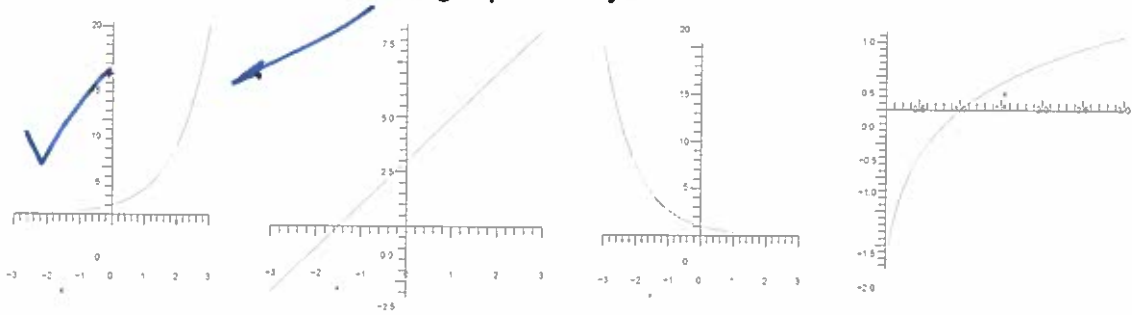
X-COORDINATE:  $-\frac{b}{2a} = \frac{-1.6}{2(-0.1)} = \frac{-1.6}{-0.2} = 8$

Y-COORDINATE:  $-0.1(8)^2 + 1.6(8)$   
 $= -0.1(64) + 12.8$

$$= -6.4 + 12.8$$

$$= 6.4$$

9. Which of the curves below is increasing exponentially?



LINEAR  
INCREASE

EXPONENTIAL  
DECREASE

LOGARITHMIC

10. Which of the following is equivalent to  $13^5 = 371293$ ?

- (a)  $\log_{13} 371293 = 5$
- (b)  $\log_5 13 = 371293$
- (c)  $\log_5 371293 = 13$
- (d)  $\log_{13} 5 = 371293$

$$\log_{13} (371,293) = 5$$

"THE LOGARITHM OF 371,293 BASE 13, IS 5."

11. The approximate percentage of a boy's adult height that he has reached at age  $x$  years is given by  $P = 61.8 + 36\log(x - 4)$  for  $5 \leq x \leq 15$ . What percentage of his adult height has a boy reached at age 8? Round your answer to three decimal places.

- (a) 94.311
- (b) 83.474
- (c) 111,707
- (d) 97.800

$$P = 61.8 + 36 \log(x - 4)$$

$$P = 61.8 + 36 \log(8 - 4)$$

$$P = 61.8 + 36 \log(4)$$

$$P = 61.8 + 36 (0.602)$$

$$P = 61.8 + 21.67$$

$$P = 83.474\%$$

12. Suppose you deposit \$2000 into an account paying 3.5% simple annual interest. If you make no other deposits or withdrawals, what is the value of the account after five years?

- (a) \$2381.89
- (b) \$2350.00
- (c) \$2392.52
- (d) \$2375.37

$$A = P(1 + rt)$$

$$A = \$2000(1 + 0.035(5))$$

$$A = \$2000(1.175) = \$2350$$

13. Given the Excel spreadsheet pictured below, which formula would you type into cell D2 to find the amount  $A$  in an account paying 3.7% simple annual interest if \$3500 is deposited and left alone for five years?

	A	B	C	D
1	P	r	t	A
2	3500	3.7	5	
3				

- (a)  $A2 * \text{POWER}(1 + B2, C2)$
- (b)  $A2 * B2 * C2$
- (c)  $A2 * (1 + (B2/100) * C2)$
- (d)  $A2 * \text{POWER}(1 + B2/12, 12 * C2)$

14. Jane has made the following table to compute the finance charge for her March credit card bill, which is due April 10.

Date	Payments/ purchases	Balance each day	Number of days until the balance changes	Unpaid balance times the number of days
Jul 10-12		541	x 3 =	\$1623
Jul 13-18	+325	866	x 6 =	\$5196
Jul 19-25	+127 - 250	743	x 7 =	\$5201
Jul 26-Aug 9	-250	493	x + 15 =	\$7395
<b>Total</b>			31	<u>\$19451</u>

If the annual interest rate on the card is 24%, what will the finance charge be?

$$\begin{aligned}
 \text{FINANCE CHARGE} &= (\text{AVG. DAILY BALANCE}) \times \frac{\text{APR}}{12} \\
 &= \left( \frac{\$19451}{31} \right) \cdot \frac{0.24}{12} \\
 &= (\$627.45) \cdot \frac{0.24}{12} = \$12.55
 \end{aligned}$$

15. Suppose you buy a \$2500 certificate of deposit paying 3.7% annual interest compounded annually. To the nearest cent, how much is it worth at the end of four years?

(a) \$2898.12  
 (b) \$2870.00  
 (c) \$8806.88  
 (d) \$2891.05

$$\begin{aligned}
 A &= P \left( 1 + \frac{r}{n} \right)^{nt} \\
 A &= \$2500 \left( 1 + \frac{0.037}{1} \right)^{1 \cdot 4} \\
 A &= \$2500 (1.037)^4 = \$2500 (1.15642) \\
 &= \$2891.05
 \end{aligned}$$

16. Suppose you deposit \$2000 in an account paying 4.1% annual interest, compounded monthly. If you make no other deposits or withdrawals, what is the value of the account after four years, to the nearest cent?

(a) \$2421.53  
 (b) \$2355.77  
 (c) \$2348.73  
 (d) \$2328.00

$$\begin{aligned}
 A &= P \left( 1 + \frac{r}{n} \right)^{nt} \\
 A &= \$2000 \left( 1 + \frac{0.041}{12} \right)^{12 \cdot 4} \\
 A &= \$2000 (1.003417)^{48}
 \end{aligned}$$

$$A = \$2000 (1.17789)$$

$$A = \$2355.77$$

17. If the nominal rate on a CD is 4%, what is the **effective rate**? Assume monthly compounding, and round your answer to the nearest hundredth of a percent.

$$\begin{aligned}
 \text{EFFECTIVE RATE} &= \left(1 + \frac{r}{n}\right)^{nt} - 1 \quad (t=1) \\
 &= \left(1 + \frac{0.04}{12}\right)^{12 \cdot 1} - 1 \\
 &= (1.00333)^{12} - 1 \\
 &= 1.0407 - 1 = 0.0407 = 4.07\%
 \end{aligned}$$

18. What is the **present value** of a payment of \$10,000 due ten years from today, assuming an annual discount rate of 5.3%?

$$\begin{aligned}
 A &= P \left(1 + \frac{r}{n}\right)^{nt} \\
 \$10,000 &= P \left(1 + \frac{0.053}{1}\right)^{1 \cdot 10} \\
 \$10,000 &= P (1.053)^{10} \\
 \underline{\$10,000} &= \underline{P(1.676)} \qquad P = \$5966.45 \\
 1.676 & \quad \cancel{1.676}
 \end{aligned}$$

19. John computed the current price of a ten-year, \$10,000 bond using a discount rate of 4.6%, but he has just learned that he should have used a discount rate of 4.7%. Will the new current price be higher or lower than the old one?

- (a) higher  
 (b) lower  
 (c) neither—the price will not change

GOAL = \$10,000

OPTION 1:  $r = 4.6\%$   $P =$

OPTION 2:  $r = 4.7\%$   $P = \checkmark$

20. For five years Jed has been making monthly payments of \$877.60 on his 20-year, \$125,000 mortgage at 5.75% annual interest, and his principal is down to \$105,683.56. How much of his next monthly payment will **go to pay down his principal**?

MONTHLY PAYMENT: \$877.60

INTEREST:  $\$105,683.56 \left(\frac{0.0575}{12}\right) = \$506.40$

PRINCIPAL:  $\$877.60 - \$506.40 = \$371.20 \checkmark$

21. Suppose you buy a new car. You put down \$5000 in cash and finance the remaining \$21,600 with a four-year loan at 4.5% annual interest compounded monthly. To the nearest cent, what will your monthly payments be?

(a) \$606.57  
 (b) \$536.63  
 (c) \$492.56  
 (d) \$511.27

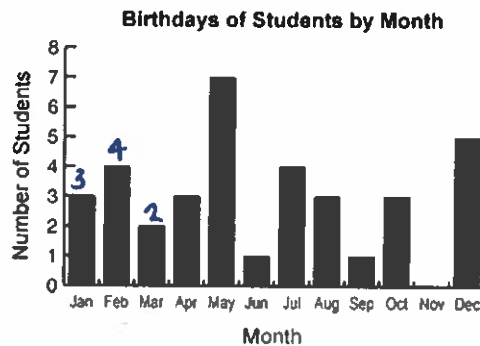
$$PMT = \frac{A \left( \frac{r}{n} \right)}{1 - \left( 1 + \frac{r}{n} \right)^{-nt}} = \frac{\$21,600 \left( \frac{0.045}{12} \right)}{1 - \left( 1 + \frac{0.045}{12} \right)^{-12 \cdot 4}}$$

$$PMT = \frac{\$81}{1 - (1.00375)^{-48}} = \frac{\$81}{1 - 0.8356} = \$492.70$$

22. Mark each data set described below 'numerical' or 'categorical'.

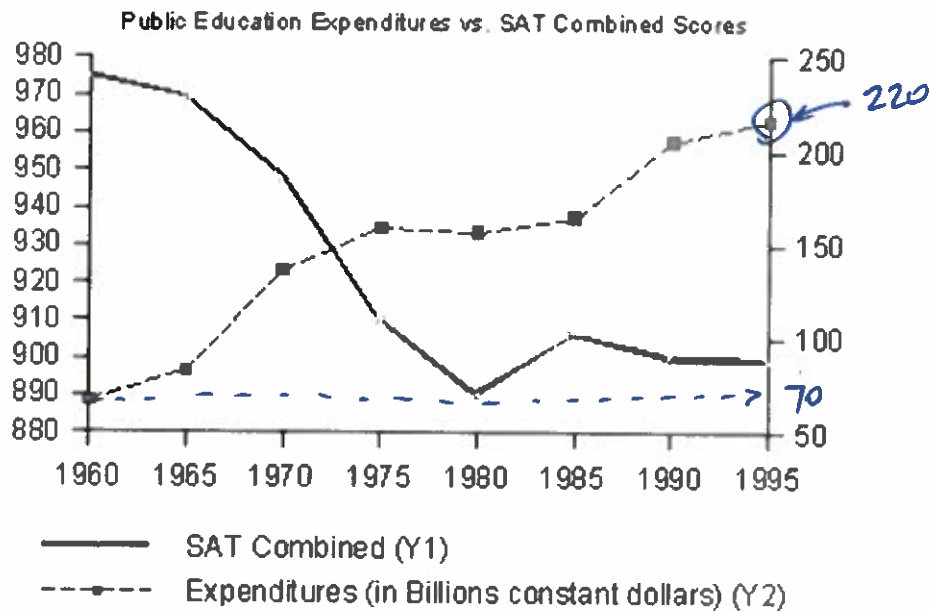
- bowling scores ← NUM.
- ~~roller coaster~~
- hat sizes ← CAT.
- lengths of text messages ← NUM.

23. The bar graph below shows data about the birthdays of students in Mrs. Jones' class. How many students have birthdays before April 1?



9

24. Approximately what was the percentage increase in public expenditure on education between 1960 and 1995, according to the double line graph shown?



- (a) 214
- (b) 150
- (c) 85
- (d) 140

$$\begin{aligned}
 \text{PERCENT INCREASE} &= \left( \frac{\text{FINAL} - \text{INITIAL}}{\text{INITIAL}} \right) \times 100 \\
 &= \frac{220 - 70}{70} = \frac{150}{70} \times 100 \\
 &= 2.14 \times 100 = 214\%
 \end{aligned}$$

25. The heights of ten different trees of the same species were measured, with the following results (in feet):

13, 13.5, 17, 16.3, 15.4, 14.1, 12.7, 16.7, 14.1, 13

What is the mean height?

$$\begin{aligned}
 \bar{x} \text{ (AVERAGE)} &= \frac{13 + 13.5 + 17 + \dots + 14.1 + 13}{10} \\
 &= 14.53 \text{ FT}
 \end{aligned}$$



26. The heights of ten different trees of the same species were measured, with the following results (in feet):

13, 13.5, 17, 16.3, 15.4, 14.1, 12.7, 16.7, 14.1, 13

What is the median height?

~~12.7, 13, 13, 13.5, 14.1, 14.1, 15.4, 16.3, 16.7, 17~~  
14.1

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27. Ed has surveyed ten smokers to find out how many cigarettes they smoke each day. His findings:

10, 14, 40, 25, 30, 25, 30, 23, 17, 35

Which measure of central tendency should be reported for this data?

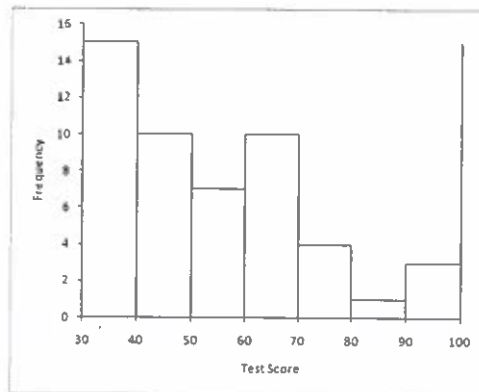
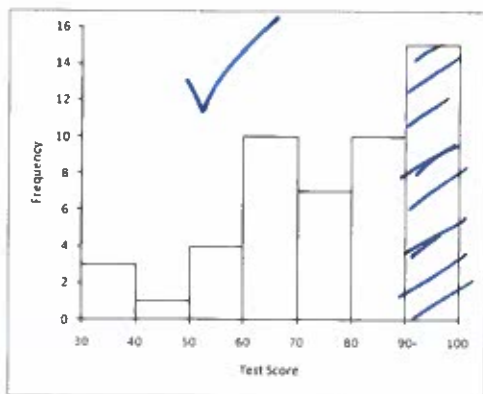
- (a) mode
  - (b) mean
  - (c) range
  - (d) median
-

28. For a particular sample of 50 scores on a Math 114 test, the following results were obtained. (Each test score was an integer between 0 and 100.)

Mean: 77.18      Variance: 317.2      **Mode: 97**      Median: 81.5  
 Standard deviation: 17.8      Range: 67      Min: 33      Max: 100

(a) Which score was obtained by more students than any other? **97**

(b) Which of the following histograms best matches this data?



29. Consider the following data sets:

**A:** 13 17 21 42 35 46 16  
**B:** 25 29 33 54 47 58 28

*+12* (curved arrow from A to B)      *+12* (curved arrow from B to A)

Note that **B** can be obtained from **A** by adding 12 to each point of **A**. If the standard deviation of set **A** is  $s$ , what is the standard deviation of set **B**? Why?

STANDARD DEVIATION SET A =  $s$

STANDARD DEVIATION SET B =  $s$

30. Jane has counted the number of words on her blogs and found that the mean number of words is 123 while the standard deviation is 8. Which of the following is a reasonable statement by the usual standards of statistics?

- (a) On average, the number of words in one of Jane's blogs differs from 123 by 8 words.
- (b) The median of Jane's data set is larger than the mean.
- (c) The histogram for Jane's data set is symmetrical.
- (d) On average, the number of words in one of Jane's blogs differs from 123 by 64 words.

31. For each of the following, state whether it is a measure of central tendency or of spread.

- mean
  - mode
  - variance
  - range
  - standard deviation
- } C.T.
- } SPREAD

32. The Excel spreadsheet shown below has been set up to find, to the nearest cent, the value of a five-year, \$2000 CD that pays 2.7% annual interest compounded monthly. Which formula should be typed into cell D2 to compute this amount?

	A	B	C	D
1	P	r	t	A
2	2000	0.027	5	
3				

- (a) `ROUND(A2*POWER(1+B2,C2))`
- (b) `A2*POWER(1+B2/12,12*C2)`
- (c) `ROUND(A2*POWER(1+B2/12,12*C2),2)`
- (d) `A2*POWER(ROUND(1+B2/12,12*C2),2)`

33. Find the median and range of the data in the stem-and-leaf diagram below.

Key: 8 | 1 = 810

Stem	Leaf
7	<del>00</del> 2 4
8	<del>1</del> 3 5 5 6 8
9	2 3 4 7 7
10	<del>1</del> 4 4 6
11	0 0 <del>1</del>

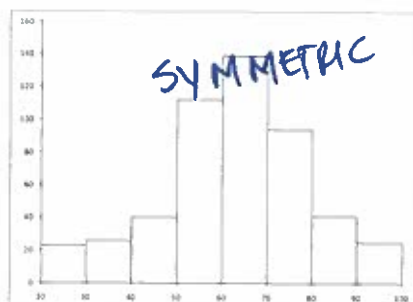
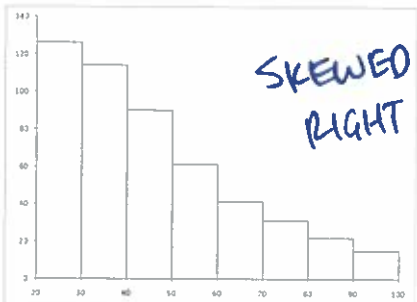
MEDIAN : 920

RANGE : MAX - MIN

$$= 1110 - 700$$

$$= 410$$

34. Mark each histogram as uniform, symmetric, bimodal, skewed left, or skewed right.



35. Find the mean, ~~median~~, and mode of the data represented in the following frequency table.

Interval	Frequency
0-12	10
12-24	8
24-36	7
36-48	6
48-60	+ 4
	<u>35</u>

MIDPOINT

6  
18  
30  
42  
54

$\bar{x}$  (MEAN) AVERAGE:

$$= \frac{10(6) + 8(18) + 7(30) + 6(42) + 4(54)}{35}$$

$$= 25.2$$

MODE: 6

36. Xavier, Yvonne, and Zenobia are running in an election in which the voting method is plurality. If Xavier gets 165 votes and Yvonne gets 414 votes, how many votes does Zenobia need to win?

- (a) 580
- (b) Zenobia cannot win this election
- (c) 166
- (d) 415

37. A club with ten members used a Borda count to elect its president this year. Rankings were as follows.

Member	1	2	3	4	5	6	7	8	9	10
Ranking	ACB	BCA	CBA	BCA	CBA	ACB	BCA	CBA	BAC	ACB

How many points did candidate A receive?

$$A: 3 + 1 + 1 + 1 + 1 + 3 + 1 + 1 + 2 + 3 = 17 \text{ PTS}$$

38. Which of the following describes the Condorcet Criterion of social choice theory?

- (a) If a candidate receives a majority of the votes, that candidate should win.
- (b) If candidate A wins a first election, then some candidates are removed and a second election is held, then candidate A should win the second election.
- (c) A candidate who wins a first election and gains additional support (without losing any of his original support) should win a second election.
- (d) If a candidate is favored when compared one-on-one with every other candidate, then that candidate should win.

39. An election with three candidates gave the following results.

Ranking	ABC	ACB	BAC	BCA	CAB	CBA
Voters	13	21	32	19	15	10

Who is the Condorcet candidate?

$$\begin{array}{r} \text{A VS. B} \\ \downarrow \quad \downarrow \\ 13 \quad 32 \\ 21 \quad 19 \\ + 15 \quad + 10 \\ \hline 49 \quad 61 \end{array}$$

B WINS!

$$\begin{array}{r} \text{B VS. C} \\ \downarrow \quad \downarrow \\ 13 \quad 21 \\ 32 \quad 15 \\ + 19 \quad + 10 \\ \hline 64 \quad 46 \end{array}$$

B WINS

B WINS

40. What does Condorcet's Jury Theorem say?

IF THE PROBABILITY THAT EACH VOTER WILL CHOOSE THE BETTER ALTERNATIVE IS GREATER THAN ONE-HALF, THEN THE PROBABILITY THAT THE GROUP WILL CHOOSE THE BETTER ALTERNATIVE INCREASES WITH THE NUMBER OF VOTERS.