

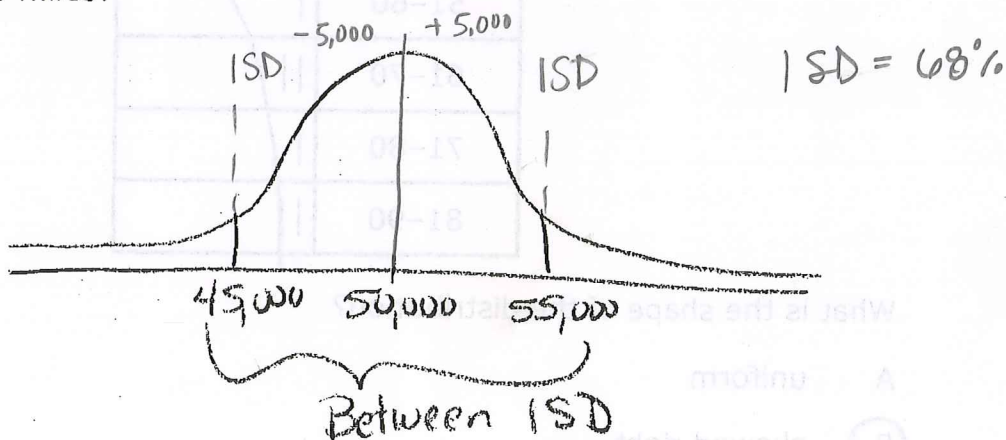
- 1 Suppose the function $H(t) = 8.5\sin(0.017t - 1.35) + 12$ models the hours of sunlight for a town in Alaska, where $t = 1$ is the first day of the year. Based on the function, what is the **approximate** range of daylight hours for the town?

- (A) 3.5 to 20.5
 B 4 to 20
 C 4.5 to 19.5
 D 5 to 19

$y_1 = 8.5\sin(0.017t - 1.35) + 12$
 put calculator in radians
 look at table find smallest
 y value & largest y value for
 the given equation

- 2 The lifetime of a particular type of car tire is normally distributed. The mean lifetime is 50,000 miles, with a standard deviation of 5,000 miles. Of a random sample of 15,000 tires, how many of the tires are expected to last for between 45,000 and 55,000 miles?

- A 7,125
 (B) 10,200
 C 14,250
 D 14,850



How many tells you
 to multiply by the
 # in the sample

$$15,000 \times 68\%$$

$$15,000 \times .68$$

$$= 10,200$$

This type problem
 was covered in the
 Statistics unit.

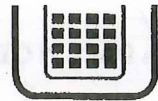


- 3 The frequency table below shows the number of runners in specific age groups for a certain race.

Age Group	Number of Runners
0-10	
11-20	
21-30	
31-40	
41-50	
51-60	
61-70	
71-80	
81-90	

What is the shape of the distribution?

- A uniform
- B skewed right
- C skewed left
- D normal



4 A spinner labeled 1 to 9 gives each of the numbers 2, 5, 7, and 9 a $\frac{3}{20}$ chance of being landed upon. The chance of landing on each of the other five numbers is equal. If the spinner is spun 1,000 times, which choice is the **most likely** outcome for the 1,000 spins?

$(\frac{3}{20}) \times 1000 = 150$
 so # of occurrences for 2, 5, 7 + 9 should be close to 150

A

Number on Spinner	1	2	3	4	5	6	7	8	9
Number of Occurrences	110	112	111	111	109	112	112	111	112

Number used

$150 \times 4 = 600$
 $1000 - 600 = 400$
 occurrences left

B

Number on Spinner	1	2	3	4	5	6	7	8	9
Number of Occurrences	82	148	78	80	149	79	151	81	152

$\frac{400}{5} = 80$
 numbers 1, 3, 4, 6, 8

so 1, 3, 4, 6, 8 should be close to 80

C

Number on Spinner	1	2	3	4	5	6	7	8	9
Number of Occurrences	120	122	100	103	108	126	113	104	104

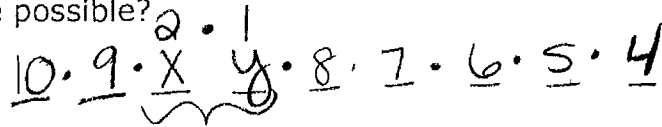
D

Number on Spinner	1	2	3	4	5	6	7	8	9
Number of Occurrences	121	100	119	120	102	120	98	121	99



5 A group of 12 people need to form a line. The line will consist of exactly 9 of the people. Person X and Person Y have to be either third or fourth in line. How many different orders are possible?

- A 79,833,600
- B 1,209,600**
- C 604,800
- D 362,880



6 The probability that it will rain on Saturday is $\frac{2}{3}$. The probability that the temperature on Saturday will reach 100°F is $\frac{4}{9}$. The probability that it will rain or reach 100°F on Saturday is $\frac{4}{5}$. What is the probability it will rain and reach 100°F on Saturday?

- A $\frac{14}{45}$**
- B $\frac{16}{45}$
- C $\frac{24}{45}$
- D $\frac{26}{45}$

$$P(\text{Rain}) + P(100^\circ\text{F}) - P(\text{Both}) = P(\text{Rain or } 100^\circ\text{F})$$

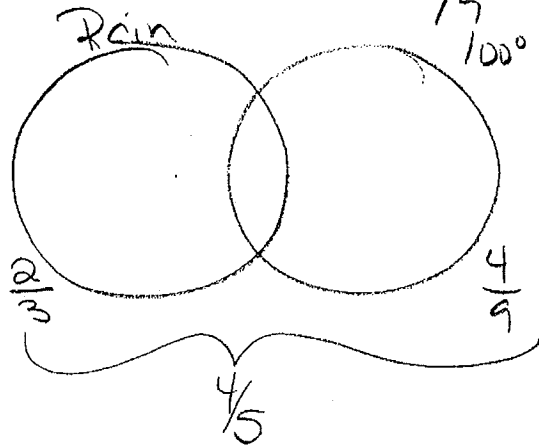
$$\frac{2}{3} + \frac{4}{9} - P(\text{Both}) = \frac{4}{5}$$

$$\frac{10}{9} - P(\text{Both}) = \frac{4}{5}$$

$$-\frac{10}{9} - P(\text{Both}) = -\frac{10}{9}$$

$$-P(\text{Both}) = -\frac{14}{45}$$

$$P(\text{Both}) = \frac{14}{45}$$





- 7 A manufacturing plant produces a special kind of lightbulb.
- Each lightbulb produced has a 0.040 probability of being defective.
 - Five lightbulbs are chosen at random from the production line.

To the nearest thousandth, what is the probability that exactly two of the five bulbs will be defective?

- A 0.014
- B 0.016
- C 0.018
- D 0.020

Binomial Probability

$$\binom{5}{2} (.04)^2 (.96)^3$$

pdf(5, .040, 2)

- 8 What is the meaning of the base of the function $y = -\log_{10}(x)$?

- A As y decreases by 1, x increases by a factor of 10.
- B As y decreases by 1, x increases by 10.
- C As y increases by 1, x increases by a factor of 10.
- D As y increases by 1, x increases by 10.

Put into y =
 ck points
 (10)
 (10, -1)
 (100, -2)
 Compare
 x & y
 values

$$-\log(x) = y$$

table

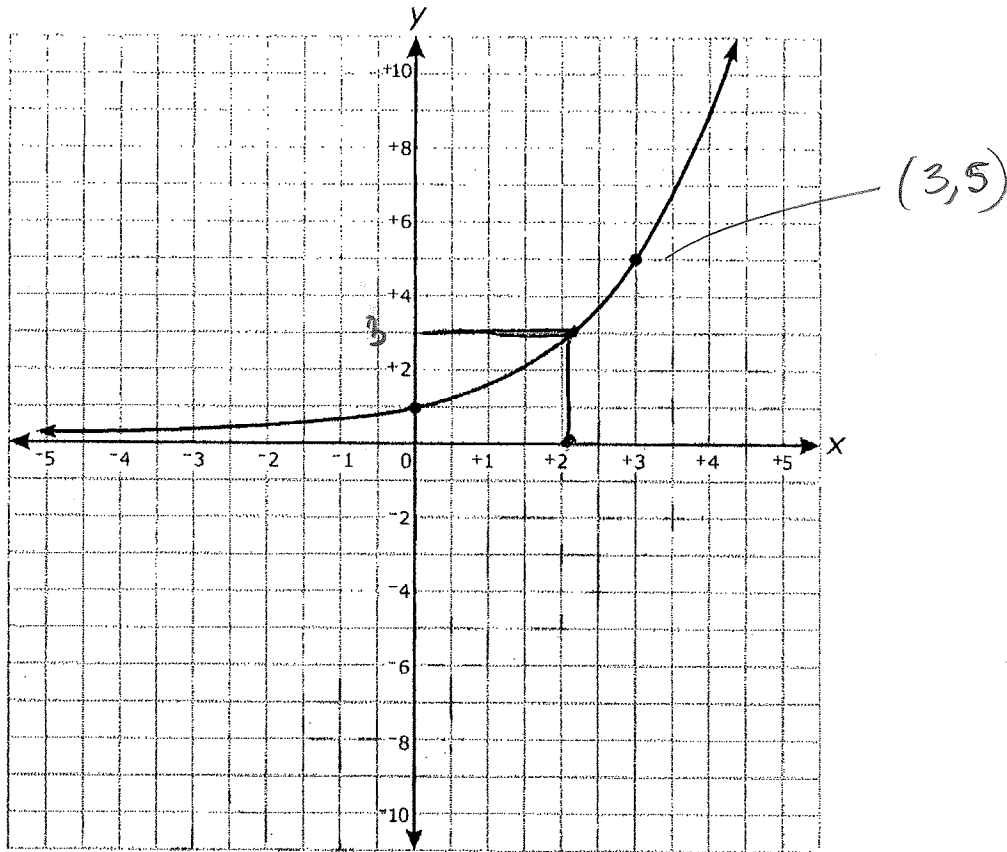
x	y
10	-1
100	-2
1000	-3

factor → means multiply by 10

increase → means to add 10



9 The graph of $y = a^x$ is shown below.



Which choice is closest to $\log_a 3$?

- A 0.9
- B 2.1
- C 3.2
- D 4.8

$x = \log_a 3$ \rightarrow $3 = a^x$
 $(?, 3)$

$\log_a 3 = x$
 $a^x = 3$
 \uparrow
 y
 $(, 3)$



10 A piecewise function is shown below.

$$h(x) = \begin{cases} -2x^2 + 5x + 10 & \text{for } -4 \leq x < 3 \\ 2x + 3p & \text{for } 3 \leq x \leq 5 \end{cases}$$

For what value of p will the function be continuous?

A $\frac{10}{3}$

B $\frac{1}{3}$

C $-\frac{25}{3}$

D $-\frac{34}{3}$

$h(3)$ for each piece

$$-2(3)^2 + 5(3) + 10 =$$

$$-2(9) + 15 + 10 = -18 + 15 + 10 = 7$$

$$2x + 3p = 7$$

$$2(3) + 3p = 7$$

$$6 + 3p = 7$$

$$3p = 1$$

$$p = \frac{1}{3}$$

*2nd piece
4x time*

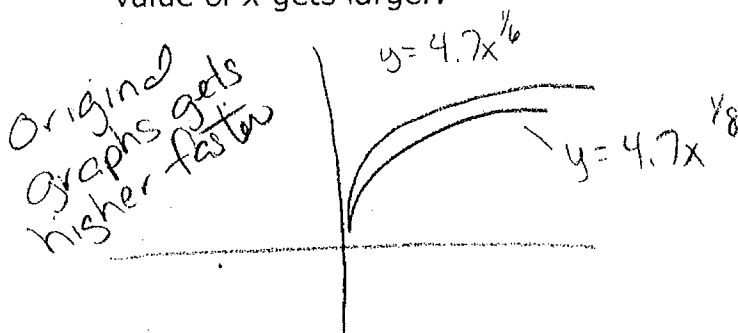
11 The equation $y = 4.7x^{\frac{1}{6}}$ is graphed on the coordinate plane. How does increasing the denominator of the exponent transform the graph?

A The transformed graph will approach a horizontal asymptote while the original graph will not.

B The transformed graph will not approach a horizontal asymptote while the original graph will.

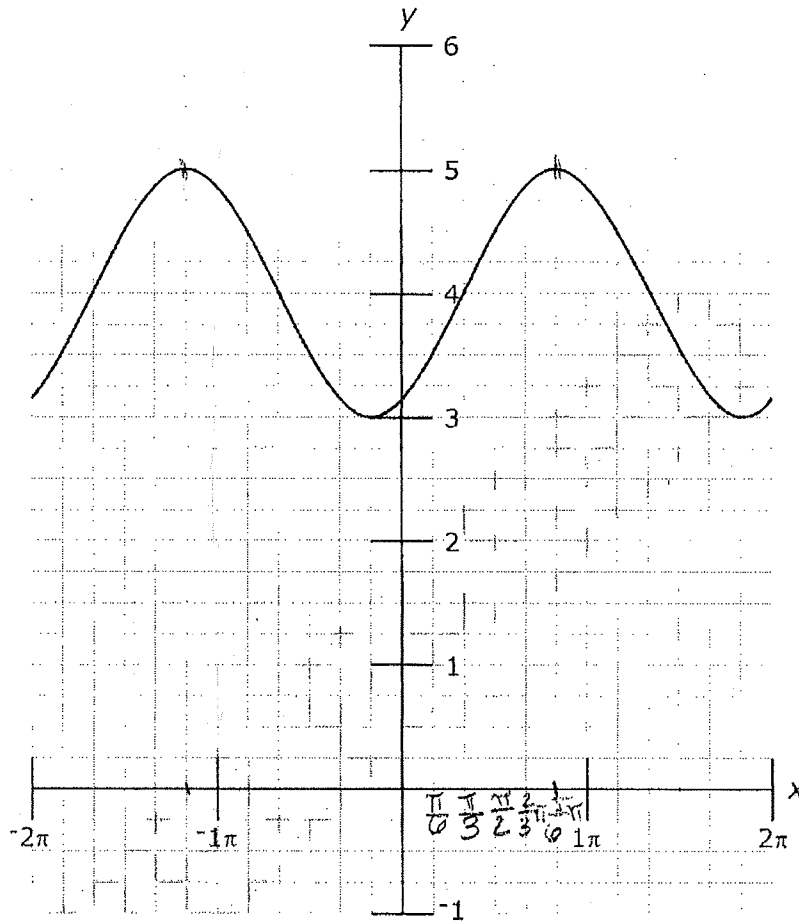
C The transformed graph will go to ∞ slower than the original graph as the value of x gets larger.

D The transformed graph will go to ∞ faster than the original graph as the value of x gets larger.





12 Which function correctly represents the graph below?



- A $y = \sin\left(x - \frac{\pi}{3}\right) + 4$ max @ 5 y-int @ 3.134
- B $y = \sin\left(x + \frac{\pi}{3}\right) + 4$ y-int @ 4.86
- C $y = \cos\left(x - \frac{\pi}{3}\right) + 4$ y-int @ 4.5
- D $y = \cos\left(x + \frac{\pi}{3}\right) + 4$ y-int @ 4.5



- 13 Which function has an amplitude that is twice the size and a period that is three times the size of the function $y = 3 \cos\left(\frac{x}{4} - 1\right) + 2$?

(A) $y = 6 \sin\left(\frac{x}{12} - 3\right) + 1$

(B) $y = \frac{3}{2} \cos\left(\frac{3x}{4} + 1\right) - 3$

(C) $y = 6 \cos\left(\frac{3x}{4} - 1\right) + 3$

(D) $y = \frac{3}{2} \sin\left(\frac{x}{12} + 3\right) - 1$

$A=6$

$\frac{2\pi}{\frac{1}{4}} = 8\pi \times 3 = 24\pi$

$\frac{2\pi}{\frac{1}{12}} = 24\pi$

$3 \times 2 = 6$

only A & C

per: $\left(\frac{2\pi}{\frac{1}{4}}\right) \times 3 =$

$\frac{2\pi}{x} = 24\pi$

$\frac{2}{24} = x$

$x = \frac{1}{12}$

(Northeast)

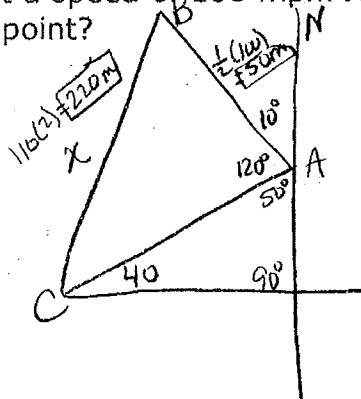
- 14 A plane takes off and travels at an angle of 40° north of east at 110 mph for 2 hours. It then adjusts its path to head 10° west of north and travels in that direction for half an hour at a speed of 100 mph. **Approximately** how far away is the plane from its starting point?

A 182 miles

B 200 miles

C 238 miles

(D) 249 miles

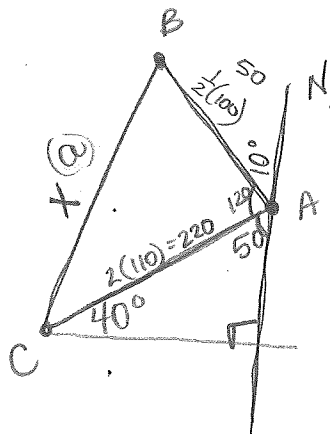


$a^2 = b^2 + c^2 - 2bc \cos A$

$a^2 = 220^2 + 50^2 - 2(220)(50) \cos 120$

$a^2 = 61900$

$a = 248.797$



$a^2 = 220^2 + 50^2 - 2(220)(50) \cos 120$

$a^2 = 61900$

$a = 248.797$

≈ 249

ADVANCED FUNCTIONS AND MODELING — RELEASED ITEMS



$$b_2 = 12$$

$$b_3 = 18$$

$$b_4 = 36$$

15 Which statement is true about the fifth terms of the two sequences below?

$$b_2 = 3(b_{2-1} - 6) = 3(b_1 - 6) = 3(10 - 6) = 3(4) = 12$$

$$a_5 = 3(5)^2 - 6 = 69$$

$$b_3 = 3(b_{3-1} - 6) = 3(b_2 - 6) = 3(12 - 6) = 3(6) = 18$$

$$b_5 = 3(b_{5-1} - 6) = 3(b_4 - 6) = 3(36 - 6) = 3(30) = 90$$

~~A~~

The fifth term of the recursive sequence exceeds the fifth term of the explicit sequence by 63.

~~B~~

The fifth term of the explicit sequence exceeds the fifth term of the recursive sequence by 63.

C

The fifth term of the recursive sequence exceeds the fifth term of the explicit sequence by 21.

D

The fifth term of the explicit sequence exceeds the fifth term of the recursive sequence by 21.

$$b_4 = 3(b_{4-1} - 6) = 3(b_3 - 6) = 3(18 - 6) = 3(12) = 36$$

$$b_5 = 90$$

$$b_5 = 3(b_{5-1} - 6) = 3(b_4 - 6) = 3(36 - 6) = 3(30) = 90$$

16 Which statement is true about the series shown below?

$$-4 + -2 + -1 + \frac{-1}{2} + \frac{-1}{4} + \dots$$

A

The series converges because $|r| < 1$.

B

The series diverges because $|r| < 1$.

~~C~~

The series converges because $|r| > 1$.

~~D~~

The series diverges because $|r| > 1$.

$$r = \frac{-2}{-4} = \frac{1}{2}$$

for infinite geo series

$$|r| < 1$$

to converge

$$15) a_5 = 3(5)^2 - 6 = 75 - 6 = 69$$

$$a_5 = 75 - 6 = 69$$

$$b_5 = 90$$

$$b_2 = 3(b_{2-1} - 6)$$

$$b_2 = 3(10 - 6) = 12$$

$$b_3 = 3(b_{3-1} - 6)$$

$$= 3(12 - 6) = 18$$

$$b_4 = 3(b_{4-1} - 6)$$

$$b_4 = 3(18 - 6) = 36$$

$$b_5 = 3(b_{5-1} - 6)$$

$$= 3(36 - 6) = 90$$



17 What is the explicit form of the equation $a_n = a_{n-1} + 2(n - 1)$; $a_1 = 1$?

A $a_n = 2n - 1$

$a_1 = 1$

$a_2 = 3$

B $a_n = n^2 - n + 1$

$a_2 = a_{2-1} + 2(2-1)$

$= a_1 + 2(1)$

$= 1 + 2 = 3$

C $a_n = n^2 - 2n + 2$

$a_3 = a_{3-1} + 2(3-1)$

$a_3 = 7$

$= a_2 + 2(2)$

$= 3 + 4 = 7$

D $a_n = 2n^2 - 2n - 1$

$a_4 = a_{4-1} + 2(4-1)$

$a_4 = 13$

$a_3 + 2(3)$

$7 + 6 = 13$

Then ck which formula works

B $a_1 = 1^2 - 1 + 1 = 1$

$a_2 = 2^2 - 2 + 1 = 3$

$a_3 = 3^2 - 3 + 1 = 7$

$a_4 = 4^2 - 4 + 1 = 13$

