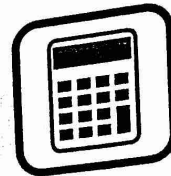


# FALL '14

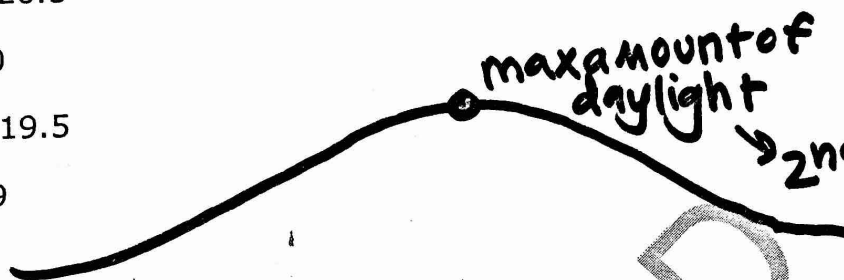


## ADVANCED FUNCTIONS AND MODELING — RELEASED ITEMS

Graph in calc **\* put calc in radian\***

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

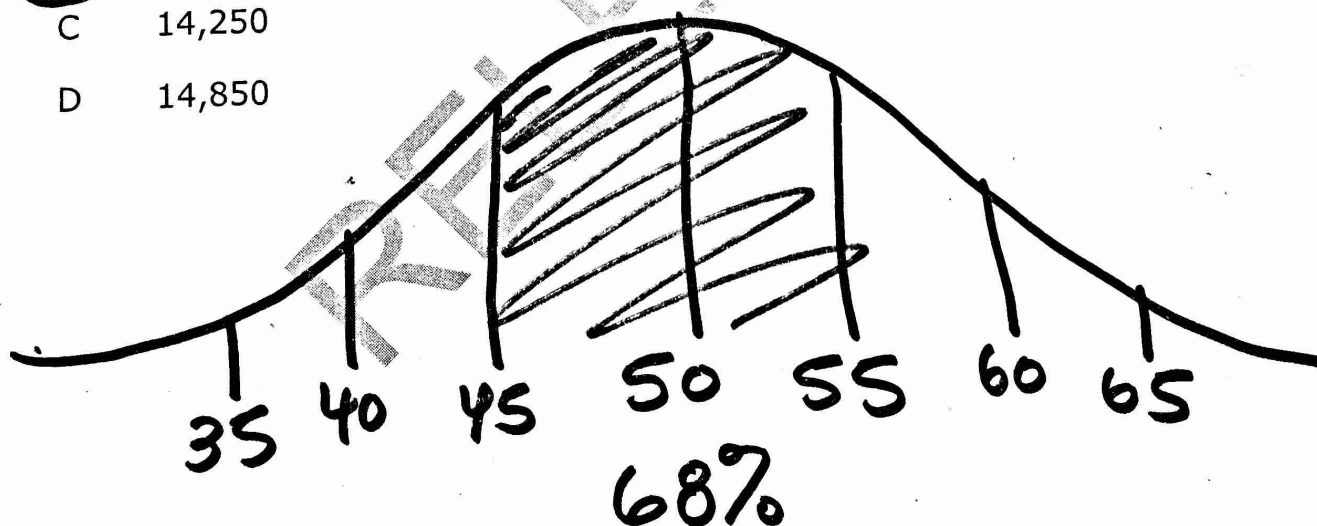


for your window use  
XMIN 0  
XMAX 365

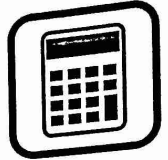
The lifetime of a particular type of car tire is normally distributed. The mean lifetime is 50,000 miles, with a standard deviation of 5,000 miles. Of a random sample of 15,000 tires, how many of the tires are expected to last for between 45,000 and 55,000 miles?

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

use empirical rule

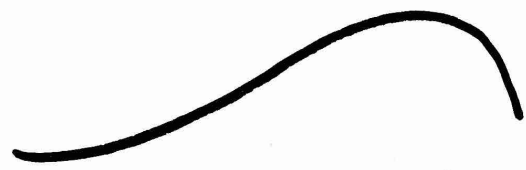


$$(.68)(15,000)$$



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	2
11-20	1
21-30	11
31-40	4
41-50	3
51-60	1
61-70	2
71-80	1
81-90	2



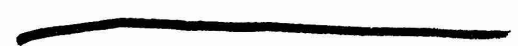
Left skewed



Right skewed



Normal

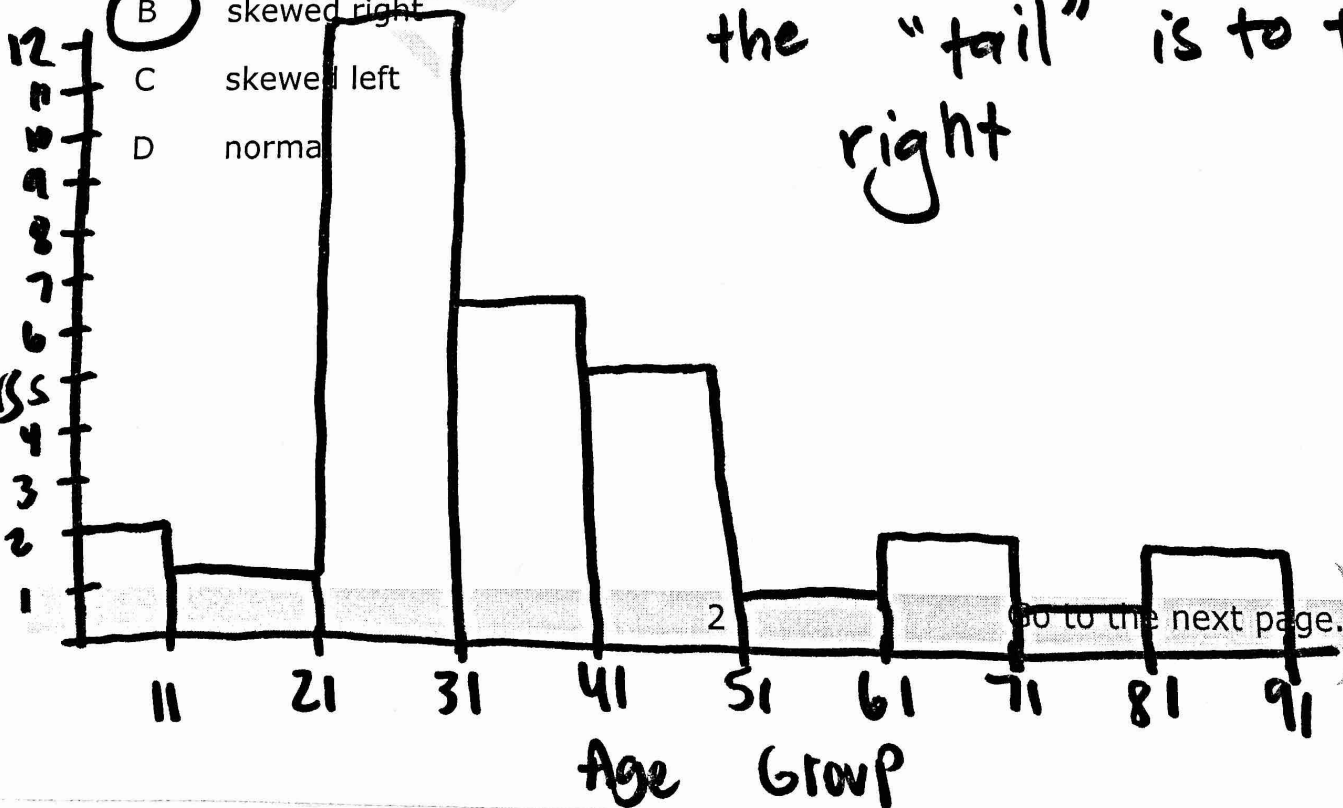


Uniform

What is the shape of the distribution?

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

the "tail" is to the right



Go to the next page.

$\frac{3}{20}$   $\frac{1.6}{20}$   $\frac{1.6}{20}$   $\frac{3}{20}$   $\frac{1.6}{20}$   $\frac{3}{20}$   $\frac{1.6}{20}$   $\frac{3}{20}$   
 2 3 4 5 6 7 8 9

← based on these probabilities there are 8/20 possibilities left to be distributed evenly to the remaining #s



ADVANCED FUNCTIONS AND MODELING — RELEASED ITEMS

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?

$\frac{8 \text{ possibilities}}{5 \text{ \#s left}} = \frac{1.6}{20}$  for each #

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

\*\*\* the #s 2, 5, 7, 9

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

have about a DOUBLED chance of being rolled!

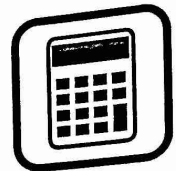
C

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

can also think about it w/ the # of rolls:  
 $(\frac{3}{20})(1,000) = 150$  ← so 2, 5, 7, 9 should be ~150  
 $(\frac{1.6}{20})(1,000) = 80$  ← so 1, 3, 4, 6, 8 should be ~80



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

Y X  
X Y

10 · 9 · 2 · 1 · 8 · 7 · 6 · 5 · 4

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

A  $\frac{14}{45}$

B  $\frac{16}{45}$

C  $\frac{24}{45}$

D  $\frac{26}{45}$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

*subtract overlap*

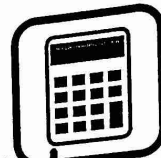
$$\frac{4}{5} = \frac{2}{3} + \frac{4}{9} - X$$

$$\frac{4}{5} = \frac{10}{9} - X$$

$$\frac{-14}{45} = -X$$

$$\frac{14}{45} = X$$





$\text{binompdf}(n, p, k)$

$n = \# \text{ of trials}$   
 $p = \text{prob. of success}$

- 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.

$k = \# \text{ of successes}$

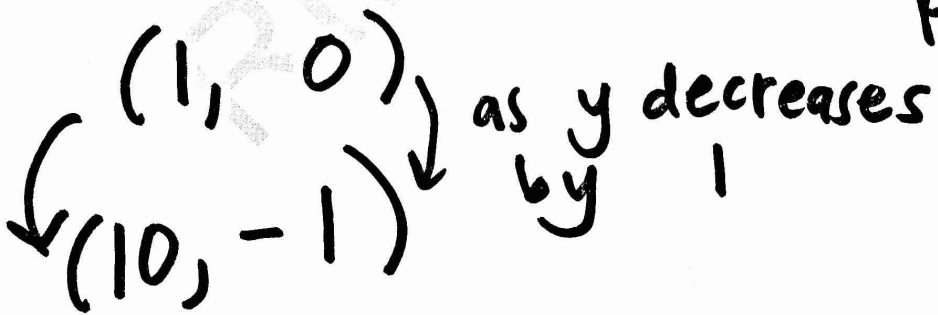
To the nearest thousandth, what is the probability that exactly two of the five bulbs will be defective?

- A 0.014  $\text{binompdf}(5, 0.040, 2) = .014155776$
- B 0.016 *nor can set it up:*
- C 0.018  $(.040)^2 \cdot (.96)^3 \cdot \frac{5!}{(3!2!)} = .014155776$
- D 0.020

8 What is the meaning of the base of the function  $y = -\log(x)$ ?

- 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.

$\leftarrow$  type into your calc and look at the ordered pairs



$x$  is increasing by a FACTOR of 10

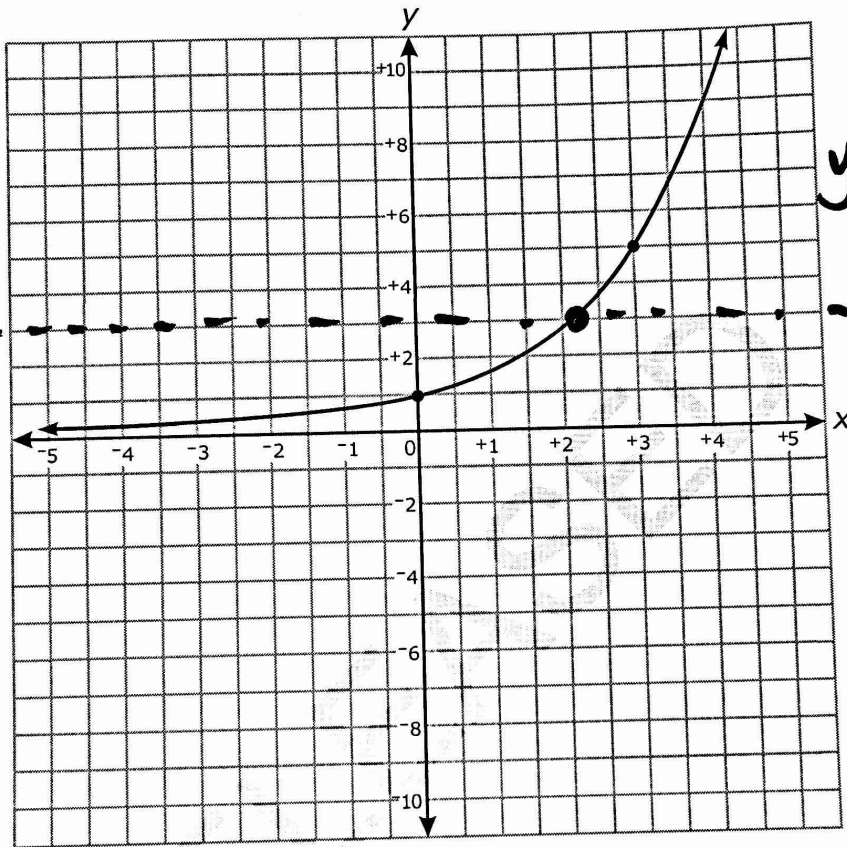


9 The graph of  $y = a^x$  is shown below.

rewrite in log form

$y = a^x \rightarrow \log_a y = x$

$y = 3$



Which choice is closest to  $\log_a 3$ ?  $\log_a y = x$

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

so  $y = 3$  and they want us to solve for  $x$



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? **continuous means they are at the same y-value for  $x=3$**

A  $\frac{10}{3}$

**B**  $\frac{1}{3}$

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

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

$$\begin{aligned} -2(3)^2 + 5(3) + 10 &= 2(3) + 3p \\ -18 + 15 + 10 &= 6 + 3p \\ 7 &= 6 + 3p \\ 1 &= 3p \end{aligned}$$

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?

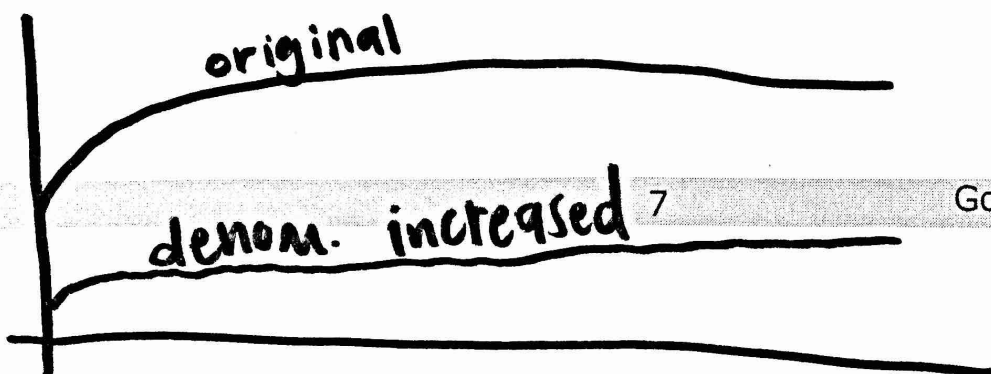
A The transformed graph will approach a horizontal asymptote while the original graph will not.

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

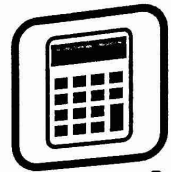
**C** The transformed graph will go to  $\infty$  slower than the original graph as the value of  $x$  gets larger.

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

**graph the original, then change the denominator & see what happens!**

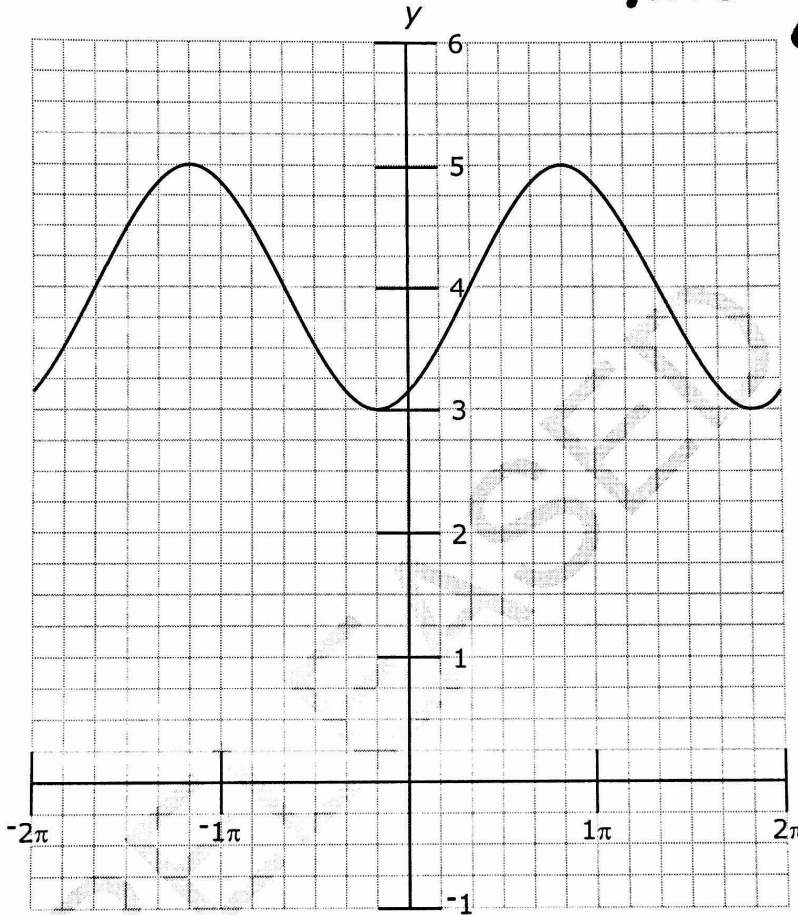


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make sure you are in **RADIAN**  
**MODE!**

12 Which function correctly represents the graph below?



change your  
**WINDOW** to  
look exactly  
like the  
picture!

**WINDOW**

$$X_{\min} = -2\pi$$

$$X_{\max} = 2\pi$$

$$X_{\text{Scl}} = \pi$$

$$Y_{\min} = -1$$

$$Y_{\max} = 6$$

$$Y_{\text{Scl}} = 1$$

graph each one in calc.  
and see which matches  
the picture!

**A**  $y = \sin\left(x - \frac{\pi}{3}\right) + 4$

B  $y = \sin\left(x + \frac{\pi}{3}\right) + 4$

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

D  $y = \cos\left(x + \frac{\pi}{3}\right) + 4$



$$y = a \sin(kx + c) + h$$



ADVANCED FUNCTIONS AND MODELING - RELEASED ITEMS

affects amplitude → affects period

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

can automatically cross out b/c their amplitude is smaller than original

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

Reminder: to find period is  $\frac{2\pi}{k}$

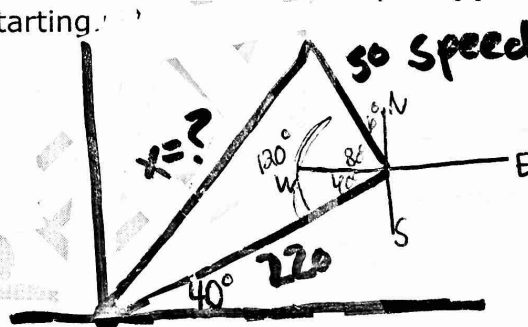
original:  $\frac{2\pi}{1/4} = 8\pi$

A)  $\frac{2\pi}{1/24} = 24\pi$  ← 3 times the size of original

C)  $\frac{2\pi}{3/4} = \frac{8\pi}{3}$  ← 3 times smaller than original

14 A plane takes off and travels at an angle of  $40^\circ$  north of east at 110 mph for 2 hours. It then adjusts its path to head  $10^\circ$  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



so speed =  $\frac{\text{distance}}{\text{time}}$

distance = speed · time

first leg distance:  
distance =  $110 \cdot 2 = 220$  miles

second leg distance:  
distance =  $100 \cdot \frac{1}{2} = 50$  miles

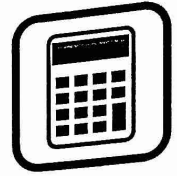
$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$x^2 = (220)^2 + (50)^2 - 2(220)(50) \cos(130^\circ)$$

\*DEGREE MODE\*

$x = 248.8$

$x \sim 249$  miles



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

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

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

Recursive  $b_n = 3(b_{n-1} - 6); b_1 = 10$   $b_2 = 12$   $b_3 = 18$   $b_4 = 36$   $b_5 = 90$

- 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.

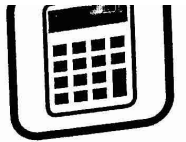
16 Which statement is true about the series shown below?

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

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

- 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  $|r| > 1$ .

if you add up the #s the sum is barely changing!  
it is converging towards a single #!



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

A  $a_n = 2n - 1$

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

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

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

find the first few terms:  
1, 3, 7, 13, 21

$$a_2 = 1 + 2(2-1)$$

$$a_3 = 3 + 2(3-1)$$

$$a_4 = 7 + 2(4-1)$$

$$a_5 = 13 + 2(5-1)$$

now plug in

- n=1
- n=2
- n=3
- n=4
- n=5

to see which has the same sequence

1, 3, 7, 13, 21