

The Candy Factory

Sequences

Name ANSWER KEY

Directions: If a question can be solved using a sequence related formula(s), please do so. Be sure to show all work.

1. Chocolate candies on a conveyor belt pass through a processing room for wrapping at a constant rate. Every 30 minutes, the constant rate is increased according to the following pattern:

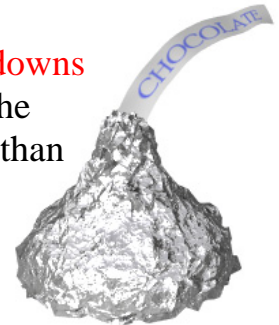
10, 15, 20, 25, 30, 35, ... one hour breakdowns

This pattern represents the number of candies on the conveyor belt in the processing room at any given time in 30 minute intervals, with no less than 10 candies on the belt. How many candies will be on the belt in the processing room as the 4th hour begins? Arithmetic sequence, $d = 5$

$$a_n = a_1 + (n - 1)d$$

$$a_7 = 10 + (7 - 1)5 \quad 40 \text{ candies}$$

$$a_7 = 40$$



2. On Tuesday, the candy factory supervisor decides to increase the number of candies on the conveyor belt in the processing room by 5 candies every 30 minutes. How many additional candies will now be on the belt in the processing as the 4th hour begins?

5

3. During a holiday season, additional workers are hired to help meet the demand for boxes of candies. As additional workers are hired, the number of cases packed per day for 5 days increases: 80 cases, 160 cases, 320 cases, 640 cases, 1280 cases.

a.) How many cases are packed in these five days? Geometric sequence, $r = 2$

$$S_n = \frac{a_1(1 - r^n)}{1 - r}$$

$$S_5 = \frac{80(1 - 2^5)}{1 - 2} = 2480 \text{ case}$$

b.) If this increased pattern continues, how many cases will be packed on the 10th day?

$$a_n = a_1 \cdot r^{n-1}$$

$$a_{10} = 80 \cdot 2^{10-1} = 40,960 \text{ cases}$$

c.) How many total cases will be packed in these 10 days?

$$S_n = \frac{a_1(1 - r^n)}{1 - r}; \quad S_{10} = \frac{80(1 - 2^{10})}{1 - 2} = 81,840 \text{ cases}$$

4. The candy factory sends a shipment of 180 cases of the chocolate candies to a large local candy store every 30 days. The candies are sold to customers at a steady rate. The inventory of cases on hand, x days after a shipment arrives is represented by

$$f(x) = 180 - 6x.$$

a.) What is the average daily inventory of cases of chocolates for the candy store over a 30 day period?

Day	Days after arrival	Inventory
1	0	180
2	1	174
3	2	168
4	3	162
5	4	156
6	5	150
	...	
30	29	6

Arithmetic sequence, $d = 6$

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

$$S_{30} = \frac{30(180 + 6)}{2} = 2790 \text{ total inventory}$$

$$\frac{2790}{30} = 93 \text{ average daily inventory}$$

b.) The candy store keeps the chocolates in an air-cooled room during the summer months to prevent melting. If the cost of cooling one case is 5 cents per day, find the average daily holding cost for the chocolates on hand.

$$93 \times 0.05 = \$4.65$$

5. At a party, the boxes of chocolate candies are stacked in a 6 layer pyramid for display. From the top, the layers contain the following number of boxes: 1, 4, 9, ..., 36 where each layer is the square of its position in the pyramid.

a.) Find the total number of boxes in the pyramid.

$$1 + 4 + 9 + 16 + 25 + 36 = 91 \text{ boxes}$$

b.) Write a formula to express this sequence.

$$a_n = n^2$$

c.) Express the series representing the sum of the boxes in each layer in sigma notation.

$$\sum_{n=1}^6 n^2$$