Aim: How can we use arithmetic sequences to help us solve word problems?

1) You are hosting a holiday pizza party. The total cost for ordering cheese pizzas from Via Roma is shown below.
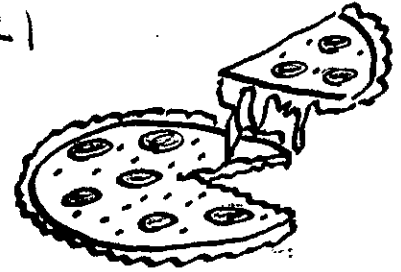
Total Number of Pizzas Ordered	Cost
1	$13.00
2	$26.00
3	$39.00
4	$52.00
5	$65.00

$+13$
$+13$
$+13$
$+13$

$d = a_2 - a_1$
$d = 26 - 13$
$\boxed{d = 13}$

a. Write an explicit formula for this arithmetic sequence.

$a_1 = 13$

$d = 13$

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

$a_n = 13 + (n-1)13$

$a_n = 13 + 13n - 13$

$\boxed{a_n = 13n}$

b. Use the explicit formula to determine the cost of dozen pizza pies.

$n = 12$

$a_n = 13n$

$a_{12} = 13(12)$

$\boxed{a_{12} = 156}$ $\boxed{\$156}$

c. Use the explicit formula to determine the cost of 25 pizza pies.

$n = 25$

$a_n = 13n$

$a_{25} = 13(25)$

$\boxed{a_{25} = 325}$ $\boxed{\$325}$

d. If you paid $390 dollars, how many pizza pies did you purchase?

$a_n = 390$

$a_n = 13n$

$\dfrac{390}{13} = \dfrac{13n}{13}$

$30 = n$

$\boxed{30 \text{ pizzas}}$

2) For your birthday you were given a metro card worth $100. Each time you ride the subway a certain amount of money is taken off the card. You and your friends take the subway from Penn station to watch the Christmas Spectacular featuring the Rockettes. The table below shows how much money is on the card after each ride.

Rides	1	2	3	4	5
Money Left ($)	97.5	95	92.5	90	87.5

$-2.5 \quad -2.5 \quad -2.5 \quad -2.5$
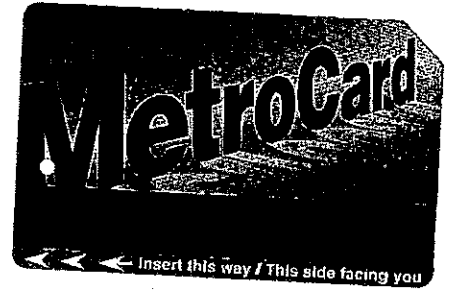
(a) Write an explicit formula for this arithmetic sequence.

$d = a_2 - a_1$

$d = 95 - 97.5$

$d = -2.5$

$a_1 = 97.5$

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

$a_n = 97.5 + (n-1) \cdot -2.5$

$a_n = 97.5 - 2.5n + 2.5$

$\boxed{a_n = -2.5n + 100}$

(b) How much money will be remaining on your card after 32 rides?

$n = 32$

$a_n = -2.5n + 100$

$a_{32} = -2.5(32) + 100$

$a_{32} = 20 \quad \boxed{\$20.00}$

(c) How many rides can you take with $37.50 remaining on the card?

$a_n = 37.50$

$a_n = -2.5n + 100$

$37.50 = -2.5n + 100$

$-100 \qquad\qquad -100$

$\dfrac{-62.5}{-2.5} = \dfrac{-2.5n}{-2.5}$

$25 = n \qquad \boxed{25 \text{ rides}}$

(d) How many rides can you take before the card runs out of money?

$a_n = 0$

$a_n = -2.5n + 100$

$0 = -2.5n + 100$

$-100 \qquad\qquad -100$
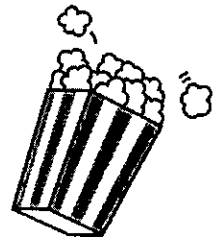
$\dfrac{-100}{-2.5} = \dfrac{-2.5n}{-2.5}$

$40 = n \qquad \boxed{40 \text{ rides}}$

3) Riley has a movie rental card worth $175. Every Friday night she invites her friends over for a movie night. After she rents the first movie (Black Panther), the card's value is $172.25. After she rents the second movie (Avengers), its value is $169.50. After she rents the third movie (Dead Pool), the card is worth $166.75.

a) Assuming the pattern continues, write an explicit formula to define a_n , the amount of money on the rental card after n rentals.

n	a_n
0	175
1	172.25
2	169.50
3	166.75

$172.25 \rbrack -2.75$

$$d = a_2 - a_1$$
$$d = 172.25 - 175$$
$$d = -2.75$$

$$a_n = a_1 + (n-1)d$$
$$a_n = 172.25 + (n-1)(-2.75)$$
$$a_n = \boxed{172.25} - 2.75n \boxed{+2.75}$$

$$\boxed{a_n = -2.75n + 175}$$

b) How many weeks in a row can she afford to rent a movie, using her rental card only? Explain how you arrived at your answer.

$$a_n = 0$$

$$a_n = -2.75n + 175$$
$$0 = -2.75n + 175$$
$$\underline{-175 \qquad\qquad -175}$$
$$\frac{-175}{-2.75} = \frac{-2.75n}{-2.75}$$

$$63.636363 = n$$

Riley can only rent 63 weeks in a row. At the 64 week Riley will not have enough money to rent a movie

Name: _____   **Date:** _____

The Greek theater shown at the right has 30 seats in the first row of the center section. Each row behind the first row gains two additional seats.

a. Write an explicit formula for this sequence.

$a_1 = 30$

$d = 2$

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

$a_n = 30 + (n-1)2$

$a_n = 30 + 2n - 2$

$\boxed{a_n = 2n + 28}$

b. How many seats are in the 5th row in the center section?

$n = 5$

$a_5 = 2(5) + 28$

$a_5 = 38$

$\boxed{38 \text{ seats}}$

c. If are sitting in a row with 62 seats, which row are you sitting in?

$a_n = 62$

$a_n = 2n + 28$

$62 = 2n + 28$

$-28 \qquad\qquad -28$

$\dfrac{34}{2} = \dfrac{2n}{2}$

$17 = n$

$\boxed{17\text{th row}}$

3. Nikko is downloading episodes of his favorite TV show to play on his personal media device. The cost of one episode is $1.99. The cost to download two episodes is $3.98. The cost to download three episodes is $5.97.

a. Write an explicit formula to represent the arithmetic sequence.

$a_1 = 1.99$

$d = 1.99$

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

$a_n = 1.99 + (n-1)1.99$

$a_n = 1.99 + 1.99n - 1.99$

n	a_n
1	1.99
2	3.98
3	5.97

1.99

$\boxed{a_n = 1.99n}$

b. What is the cost to download 26 episodes?

$n = 26$

$a_{26} = 1.99(26)$

$a_{26} = 51.74$

$\boxed{\$51.74}$

4. The price to send a large envelope first class mail is 88 cents for the first ounce and 17 cents for each additional ounce. The table below shows the cost for weights up to 5 ounces.

a. Write the explicit formula.

$a_1 = .88$

$d = .17$

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

$a_n = .88 + (n-1).17$

Weight (ounces)	1	2	3	4	5
Postage (cents)	0.88	1.05	1.22	1.39	1.56

Source: United States Postal Service

.17 .17 .17 .17

$.88 + .17n - .17$

$a_n = .17n + .71$

b. What is the weight of a large envelope if it costs $2.07?

$2.07 = .17n + .71$

$-.71 \qquad -.71$

$\dfrac{1.36}{.17} = \dfrac{.17n}{.17}$

$\boxed{8 = n}$

4) The Greek theater shown at the right has 30 seats in the first row of the center section. Each row behind the first row gains two additional seats.

a. Write an explicit formula for this sequence.

$a_1 = 30$

$d = 2$

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

$a_n = 30 + (n-1)2$

$a_n = 30 + 2n - 2$

$$\boxed{a_n = 2n + 28}$$

b. How many seats are in the 5th row in the center section?

$n = 5$
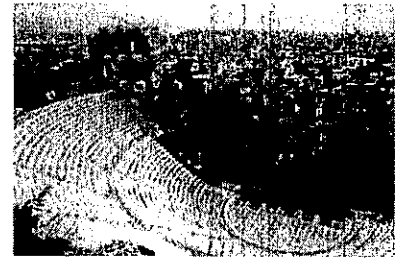
$a_5 = 2(5) + 28$

$a_5 = 38$

$$\boxed{38 \text{ seats}}$$

c. If are sitting in a row with 62 seats, which row are you sitting in?

$a_n = 62$

$62 = 2n + 28$

$-28 \qquad -28$

$\dfrac{34}{2} = \dfrac{2n}{2}$ $n = 17$ $\boxed{17\text{th row}}$

5) The price to send a large envelope first class mail is 88 cents for the first ounce and 17 cents for each additional ounce. The table below shows the cost for weights up to 5 ounces.

a. Write the explicit formula.

$a_1 = .88$

$d = 17$

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

$a_n = .88 + (n-1).17$

$a_n = .88 + .17n - .17$

Weight (ounces)	1	2	3	4	5
Postage (cents)	0.88	1.05	1.22	1.39	1.56

Source: United States Postal Service

$$\boxed{a_n = .17n + .71}$$

b. What is the weight of a large envelope if it costs $2.07?

$2.07 = .17n + .71$

$-.71 \qquad\qquad -.71$

$\dfrac{1.36}{.17} = \dfrac{.17n}{.17}$

$8 = n$ $\boxed{8 \text{ ounces}}$