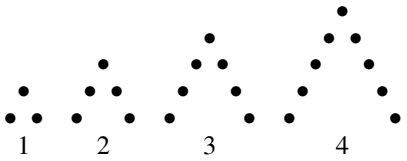
Grade 9 - Linear Relations

Name: _____ **Date:** _____

1. If this pattern of dot-figures were continued, how many dots will be in the 100th figure?



A. 100 B. 101 C. 199

D. 200 E. 201

2. (2, 5), (4, 9), (6, 13)

Which of the following describes what to do to the first number in each ordered pair above to obtain the corresponding second number?

A. Add 3

B. Subtract 3

C. Multiply by 2

D. Multiply by 2 and subtract 1

E. Multiply by 2 and add1

3. The cost to rent a motorbike is given by the following formula:

$$\text{Cost} = (\$3 \times \text{number of hours}) + \$2$$

Fill in the table.

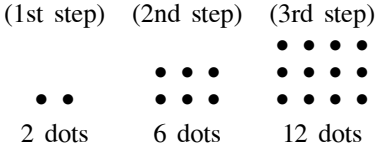
Time in Hours	Cost in Dollars
1	5
4	
	17

4. John records the weight of his puppy every month in a chart like the one shown. If the pattern of the puppy's weight gain continues, how many pounds will the puppy weigh at 5 months?

A. 30 B. 27 C. 25 D. 24

Puppy's Age	Puppy's Weight
1 month	10 lbs.
2 months	15 lbs.
3 months	19 lbs.
4 months	22 lbs.
5 months	?

5. A pattern of dots is shown. At each step, more dots are added to the pattern. The number of dots added at each step is more than the number added in the previous step. The pattern continues infinitely.



Marcy has to determine the number of dots in the 20th step, but she does not want to draw all 20 pictures and then count the dots.

Explain or show how she could do this *and* give the answer that Marcy should get for the number of dots.

6. If the pattern shown in the table were continued, what number would appear in the box at the bottom of column B next to 14?

A. 19 B. 21 C. 23

D. 25 E. 29

A	B
2	5
4	9
6	13
8	17
14	?

7. Which of the following ordered pairs (x, y) is a solution to the equation $2x - 3y = 6$?

A. $(6, 3)$ B. $(3, 0)$ C. $(3, 2)$

D. $(2, 3)$ E. $(0, 3)$

8.

x	y
0	-3
1	-1
2	1

Which of the following equations is true for the three pairs of x and y values in the table above?

A. $3x + 2 = y$ B. $3x - 2 = y$ C. $2x + 3 = y$

D. $2x - 3 = y$ E. $x - 3 = y$

9.

Term	1	2	3	4
Fraction	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{4}{5}$

If the list of fractions above continues in the same pattern, which term will be equal to 0.95?

A. The 100th B. The 95th C. The 20th

D. The 19th E. The 15th

10. In a coordinate plane, the points $(2, 4)$ and $(3, -1)$ are on a line. Which of the following *must* be true?

A. The line crosses the x-axis.

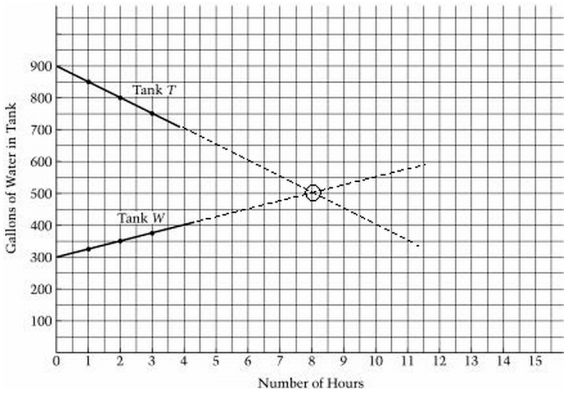
B. The line passes through $(0, 0)$.

C. The line stays above the x-axis at all times.

D. The line rises from the lower left to the upper right.

E. The line is parallel to the y-axis.

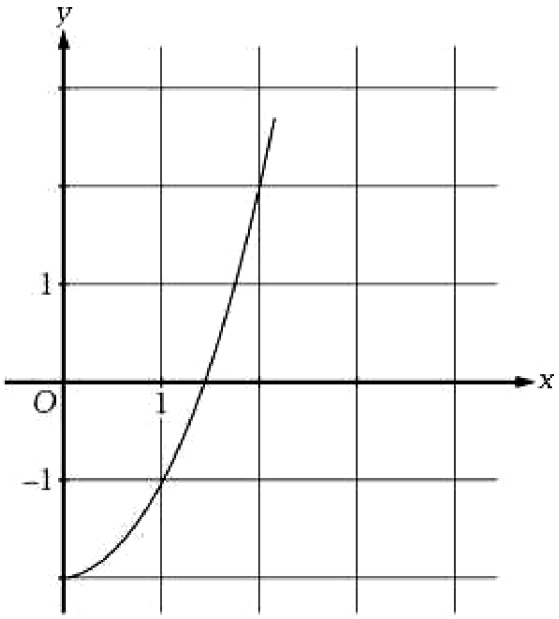
11. Two large storage tanks, T and W, contain water. T starts losing water at the same time additional water starts flowing into W. The graph below shows the amount of water in each tank over a period of hours.



Assume that the rates of water loss and water gain continue as shown. At what number of hours will the amount of water in T be equal to the amount of water in W ?

Show or explain how you found your answer.

12.

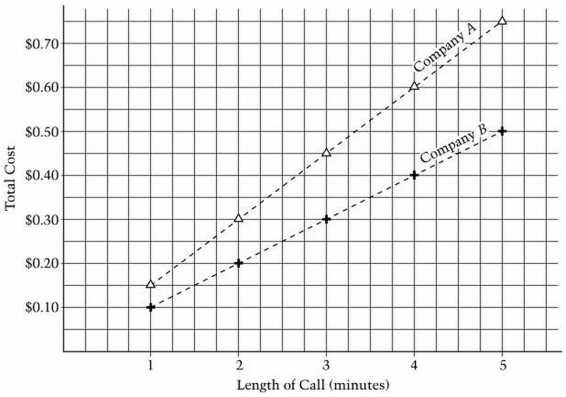


On the curve above, what is the best estimate of the value of x when $y = 0$?

A. −2.0 B. 1.1 C. 1.4

D. 1.7 E. 1.9

13. The graph below shows the cost that two long-distance telephone companies each charge for calls of various lengths (in minutes).



a) What is the cost of a 4-minute call using Company *B*?

_____

b) What is the cost per minute for a call using Company *B*?

_____

c) Determine the amounts of money saved (in cents) by using Company *B* instead of Company *A* when calls of 1, 2, 3, 4, and 5 minutes are made. Then graph the five points that represent the savings.

14. 1, 9, 25, 49, 81, . . .

The same rule is applied to each number in the pattern above. What is the 6th number in the pattern?

A. 40 B. 100 C. 121 D. 144 E. 169

15.

x	y
0	−1
1	2
2	5
3	8
10	29

Which of the following equations represents the relationship between x and y shown in the table above?

A. $y = x^2 + 1$ B. $y = x + 1$

C. $y = 3x - 1$ D. $y = x^2 - 3$

E. $y = 3x^2 - 1$

16. If $x = 2n + 1$, what is the value of x when $n = 10$?

A. 11 B. 13 C. 20 D. 21 E. 211

17. Each figure in the pattern below is made of hexagons that measure 1 centimeter on each side.

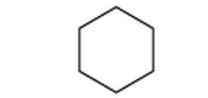


Figure 1
Perimeter = 6 cm

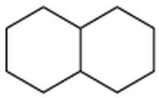


Figure 2
Perimeter = 10 cm

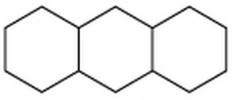


Figure 3
Perimeter = 14 cm

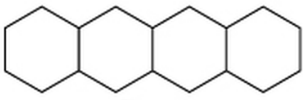


Figure 4
Perimeter = 18 cm

Show how you found your answer.

If the pattern of adding one hexagon to each figure is continued, what will be the perimeter of the 25th figure in the pattern?

18.

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
Number Sold, n	4	0	5	2	3	6
Profit, p	\$2.00	\$0.00	\$2.50	\$1.00	\$1.50	\$3.00

Angela makes and sells special-occasion greeting cards. The table above shows the relationship between the number of cards sold and her profit. Based on the data in the table, which of the following equations shows how the number of cards sold and profit (in dollars) are related?

A. $p = 2n$ B. $p = 0.5n$ C. $p = n - 2$

D. $p = 6 - n$ E. $p = n + 1$

19. Sarah has a part-time job at Better Burgers restaurant and is paid \$5.50 for each hour she works. She has made the chart below to reflect her earnings but needs your help to complete it.

a) Fill in the missing entries in the chart.

Hours Worked	Money Earned (in dollars)
1	\$5.50
4	
	\$38.50
$7\frac{3}{4}$	\$42.63

b) If Sarah works h hours, then, in terms of h, how much will she earn?

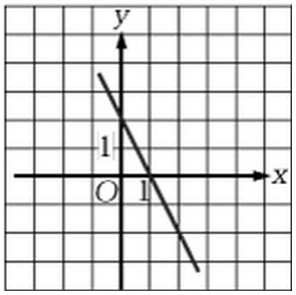
20. The temperature in degrees Celsius can be found by subtracting 32 from the temperature in degrees Fahrenheit and multiplying the result by $\frac{5}{9}$. If the temperature of a furnace is 393 degrees Fahrenheit, what is it in degrees Celsius, to the nearest degree?

A. 649 B. 375 C. 219

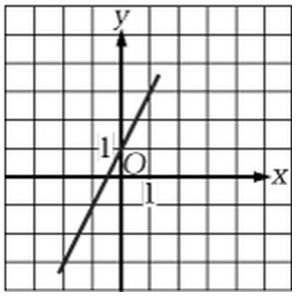
D. 201 E. 187

21. Which of the following is the graph of the line with equation $y = -2x + 1$?

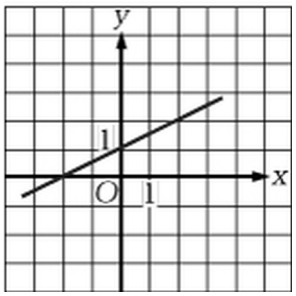
A.



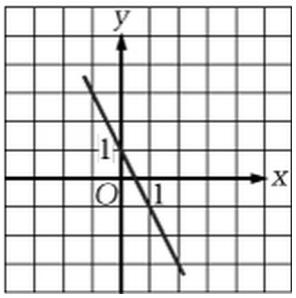
B.



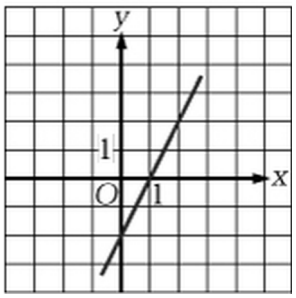
C.



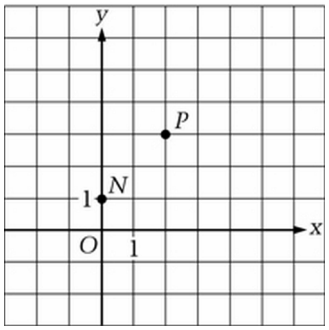
D.



E.



22.



For the figure above, which of the following points would be on the line that passes through points N and P?

A. $(-2, 0)$ B. $(0, 0)$ C. $(1, 1)$

D. $(4, 5)$ E. $(5, 4)$

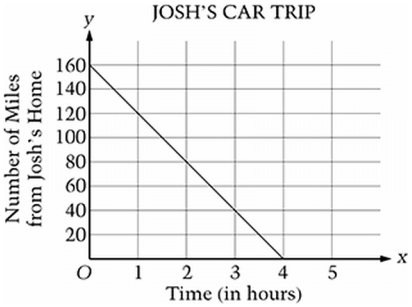
23. A reasonable prediction of the distance d in feet, that a car travels after the driver has applied the brakes can be found by using the formula $d = 0.055r^2$, where r is the speed of the car in miles per hour.

If Mario is driving at 60 miles per hour and applies the brakes, then according to the formula, how many feet will Mario's car travel before it stops?

A. 330 B. 198 C. 10.89

D. 6.6 E. 3.3

24. The linear graph below describes Josh's car trip from his grandmother's home directly to his home.



a) Based on this graph, what is the distance from Josh's grandmother's home to his home?

b) Based on this graph, how long did it take Josh to make the trip?

c) What was Josh's average speed for the trip? Explain how you found your answer.

d) Explain why the graph ends at the x-axis.

25. The Music Palace is having a sale.

Music Palace Sale
$12 for the first CD
$6 for each additional CD
(Prices include tax.)

Write an expression that shows how to calculate the cost of buying n CD's at the sale.

Answer: _____

26. The numbers in the sequence 2, 7, 12, 17, 22, ... increase by fives. The numbers in the sequence 3, 10, 17, 24, 31, ... increase by sevens. The number 17 occurs in both sequences. If the two sequences are continued, what is the next number that will be seen in both sequences?

27. The table represents a relation between x and y.

What is the missing number in the table?

A. 2 B. 3 C. 4

D. 5 E. 6

x	y
1	1
2	?
4	7
7	13

28. A rubber ball rebounds to half the height it drops. If the ball is dropped from a rooftop 18 m above the ground, what is the total distance traveled by the time it hits the ground the third time?

A. 31.5 m B. 40.5 m

C. 45 m D. 63 m

29. Here is a sequence of three similar triangles. All of the small triangles are congruent.

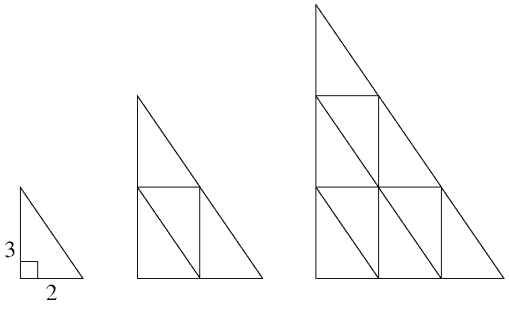


Figure 1 Figure 2 Figure 3

a) Complete the chart by finding how many small triangles make up each figure.

Figure	Number of small triangles
1	1
2	
3	

b) The sequence of similar triangles is extended to the 8th figure. How many small triangles would be needed for Figure 8?

30. The cost, C, of printing greeting cards consists of a fixed charge of 100 cents and a charge of 6 cents for each card printed. Which of these equations can be used to determine the cost of printing n cards?

A. $C = (100 + 6n)$ cents

B. $C = (106 + n)$ cents

C. $C = (6 + l00n)$ cents

D. $C = (106n)$ cents

E. $C = (600n)$ cents

31. The table shows a relations between x and y.

x	2	3	4	5
y	7	10	13	16

Which of these equations expresses this relation?

A. $y = x + 5$ B. $y = x \pm 5$

C. $y = \frac{1}{3}(x \pm 1)$ D. $y = 3x + 1$

32. The table represents a relation between x and y.

x	y
2	5
3	7
4	?
7	15

What is the missing number in the table?

A. 9 B. 10 C. II D. 12 E. 13

33. The table represents a relation between x and y.

x	y
1	1
2	4
3	7
4	10

Which of the following equations could represent the same relation?

A. $y = 2x + 2$ B. $y = 2x - 1$ C. $y = 3x + 2$

D. $y = 3x + 1$ E. $y = 3x - 2$

34. The table shows some value of x and y, where x is proportional to y:

x	4	8	Q
y	9	P	45

What are the values of P and Q?

A. $P = 40$ and $Q = 13$ B. $P = 18$ and $Q = 17$

C. $P = 20$ and $Q = 18$ D. $P = 40$ and $Q = 18$

E. $P = 18$ and $Q = 20$

35. The figures show four sets consisting of circles.

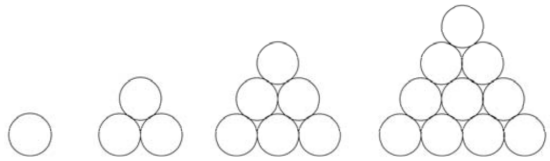


Figure 1 Figure 2 Figure 3 Figure 4

a) Complete the table below. First, fill in how many circles make up Figure 4. Then, find the number of circles that would be needed for the 5th figure if the sequence of figures is extended.

Figure	**Number of circles**
1	1
2	3
3	6
4	
5	

b) The sequence of figures is extended to the 7th figure. How many circles would be needed for Figure 7?

Answer: _____

c) The 50th figure in the sequence contains 1275 circles. Determine the number of circles in the 51st figure. Without drawing the 51st figure, explain or show how you arrived at your answer.

36. Matchsticks are arranged as shown in the figure.

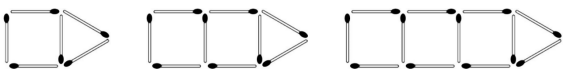
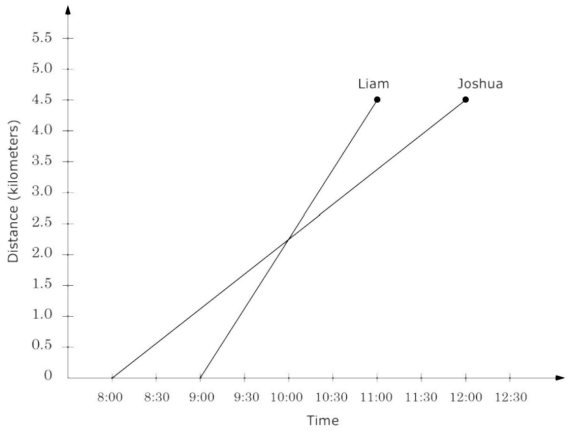


Figure 1 Figure 2 Figure 3

If the pattern is continued, how many matchsticks would be used to make Figure 10?

A. 30 B. 33 C. 36 D. 39 E. 42

37. The graph represents the distancd and time of a hike taken by Joshua and Len.



If they both started from the same place and walked in the same direction, at what time did they meet?

A. 8:00 B. 8:30 C. 9:00

D. 10:00 E. 11:00

38. $(3, 6), (6, 15), (8, 21)$

Which of these describes how to get the second number from the first number in every ordered pair above?

A. Add 3

B. Subtract 3

C. Multiply by 2

D. Multiply by 2 and then add 3

E. Multiply by 3 and then subtract 3

39. The numbers in the sequence 7, 11, 15, 19, 23, . . . increase by four. The numbers in the sequence 1, 10, 19, 28, 37, . . . increase by nine. The number 19 is in both sequences. If the two sequences are continued, what is the next number that is in BOTH the first and the second sequences?

    Answer: _____

40. The three figures below are divided into small congruent triangles.

Figure 1

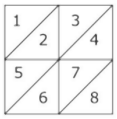


Figure 2

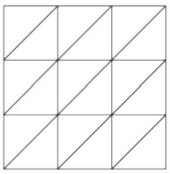


Figure 3

a) Complete the table below. First, fill in how many small triangles make up Figure 3. Then, find the number of small triangles that woud be needed for the 4th figure if the sequence of figures is extended.

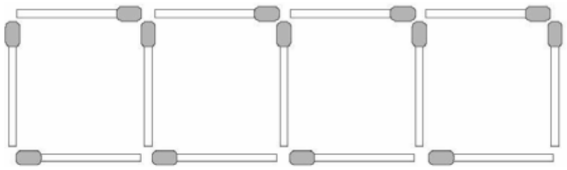
Figure	**Number of Small Triangles**
1	2
2	8
3	
4	

b) The sequences of figures is extended to the 7th figure. How many small triangles would be needed for Figure 7?

Answer: _____

c) The sequence of figures is extended to the 50th figure. Explain a way to find the number of small triangles in teh 50th figure that does not involve drawing it and counting the number of triangles.

41.



In the figure, 13 matches were used to make 4 squares in a row. What is the number of squares in a row that can be made in this way using 73 matches? Show the calculations that lead to your answer.

Answer: _____

42. The table below shows a relation between x and y.

x	1	2	3	4	5
y	1	3	5	5	9

Which of the following equations expresses this relation?

A. $y = x + 4$ B. $y = x + 1$

C. $y = 2x - 1$ D. $y = 3x - 2$

43. 2, 5, 11, 23, dots

Starting the pattern at 2, which of these rules would give each of the terms in the number pattern above?

A. Add 1 to the previous term and then multiply by 2.

B. Multiply the previous term by 2 and then add 1.

C. Multiply the previous term by 3 and then subtract 1.

D. Subtract 1 from the previous term and then multiply by 3.

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Grade 9 - Linear Relations 02/07/2013

1.
Answer: E

2.
Answer: E

3.
Answer: Time in Hours = 5 hours; Cost in Dollars = 14 dollars

4.
Answer: D

5.
Answer: 420 dots

6.
Answer: E

7.
Answer: B

8.
Answer: D

9.
Answer: D

10.
Answer: A

11.
Answer: 8 hours

12.
Answer: C

13.
Answer: 40 cents; 10 cents per minute; Points should fall on the line through $(1, 0.05)$ and $(5, 0.25)$.

14.
Answer: C

15.
Answer: C

16.
Answer: D

17.
Answer: 102

18.
Answer: B

19.
Answer:

Hours Worked	Money Earned (in dollars)
1	\$5.50
4	\$22.00
7	\$38.50
$7\frac{3}{4}$	\$42.63

5.5h

20.
Answer: D

21.
Answer: A

22.
Answer: D

23.
Answer: B

24.
Answer: (a) 160 miles (b) 4 hours (c) 40 miles per hour (d) You cannot have a negative distance, which is what you would have if you extended the line below the x-axis.

25.
Answer: $12 + 6(n - 1)$ or $6n + 6$

26.
Answer: 52

27.
Answer: B

28.
Answer: C

29.
Answer: 4 and 9; 64

30.
Answer: A

31.
Answer: D

32.
Answer: A

33.
Answer: E

34.
Answer: E

35.
Answer: 10 and 15; 28; 1326

36.
Answer: B

37.
Answer: D

38.
Answer: E

39.
Answer: 55

40.
Answer: 18 and 32
98
$2n^2$

41.
Answer: 24 with calculations

42.
Answer: C

43.
Answer: B