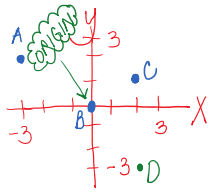
Lesson 1: Review and Preview

Friday, August 31, 2018 2:38 AM



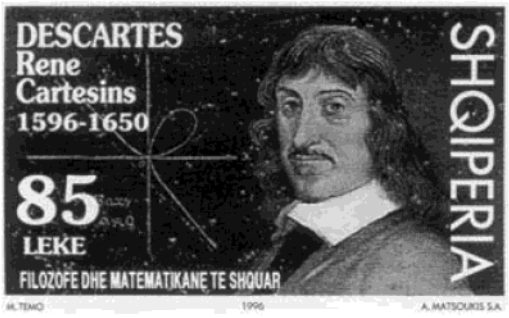
A = (-3, 2)
B = (0, 0)
C = (2, 1)
D = (2, -3)

March 2, 2020

Relations Lesson #1:
Review and Preview

This lesson reviews some important concepts that will appear throughout the next four units.

The Cartesian Coordinate System



In mathematics, "Cartesian" refers to the French mathematician **René Descartes**. In 1637 he introduced the idea of specifying the position of a point on a surface using two intersecting axes as measuring guides.

The modern Cartesian coordinate system, in two dimensions, is defined by two axes at right angles to each other forming a plane (called the *xy* plane). The horizontal axis is labelled *x*, and the vertical axis is labelled *y*. All the points in a Cartesian coordinate system form a **Cartesian plane**.

The point of intersection of the two axes is called the **origin**, usually labelled O. On each axis, a unit length is chosen and units are marked off to form a grid. To specify a particular point on the grid, we use a unique **ordered pair** of numbers called **coordinates**. The first number in the ordered pair, called the ***x*-coordinate**, identifies the position with regard to the *x*-axis, while the second number, called the ***y*-coordinate**, identifies the position with regard to the *y*-axis. The point $P(4, 3)$ is shown on the grid below. The intersection of the *x*-axis and *y*-axis creates four **quadrants**, numbered counterclockwise starting from the north-east quadrant.

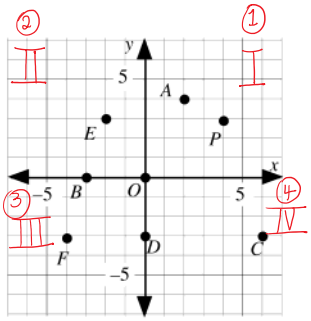
a) Complete the following by writing the coordinates of the points represented by the letters on the grid.

A(2,4) ✓ B(-3,0) ✓ C(6,-3) ✓
D(0,-3) O(0,0) ✓

b) Write the coordinates of the point in the second quadrant. E (-2,3)

c) Write the coordinates of the point in quadrant III. F (-4,-3)

omit **d)** Complete the following table using "positive" or "negative."



Quadrant	*x*-coordinate	*y*-coordinate
I		
II		
III		
IV		

form a LINE ☺

Describing a Pictorial Pattern Using a Linear Relation

Use the following information to answer this Class Example.

Three toothpicks are used to form a triangle. A second triangle is formed by adding two more toothpicks. A third triangle is formed by adding another two more toothpicks, and the pattern continues.

Example of a toothpick →

Class Ex. #2

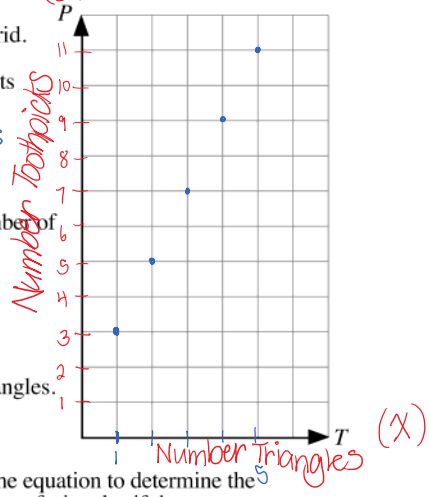
a) Draw the next two diagrams in the pattern.

b) Complete the table relating the number of toothpicks, P, to the number of triangles, T.

Number of Triangles, T	1	2	3	4	5
Number of Toothpicks, P	3	5	7	9	11

(y)

c) Represent the data from the table of values on the grid.



d) Explain why it does not make sense to join the points in a straight line.

do not connect b/c half numbers are not possible ∴ DATA is discrete

e) Describe in words the relationship between the number of toothpicks and the number of triangles.

The number of toothpicks is double the number of triangles then add one.

♡ next page

f) Write an equation that can be used to determine the number of toothpicks if we know the number of triangles.

$P = 2T + 1$ (toothpicks)

g) Use the equation to determine the number of toothpicks if there are 27 triangles.

$P = 2T + 1$ (toothpicks)

$P = 2(27) + 1$

$= 55$ toothpicks ✓

h) Use the equation to determine the number of triangles if there are 83 toothpicks.

$P = 2T + 1$ (toothpicks)

$83 = 2T + 1$ −1

$82 = 2T$

$\frac{82}{2} = \frac{2T}{2}$

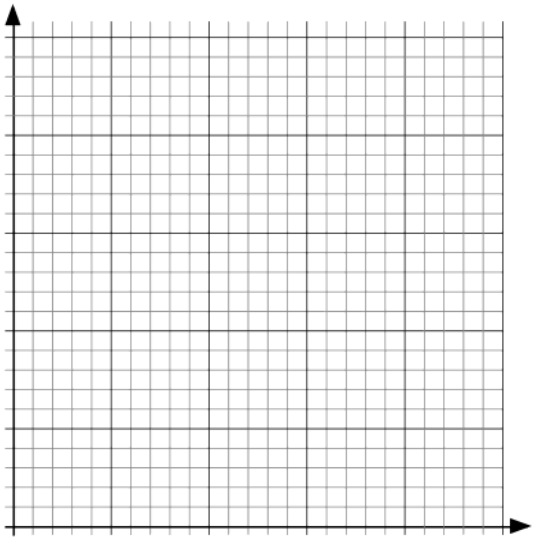
$T = 41$ triangles

Students in a Physics classroom determined the resistance in an electrical circuit by measuring the voltage (V volts) when a current (I amps) was passed through the circuit. The table below shows the results.

Current, (I) in amps	0.5	1.5	3	3.5	4
Voltage, (V) in volts	6	18	36	42	48

a) Represent the data from the table on the grid.

b) Does it make sense to join the points together with a straight line? Explain.



c) Use the graph to determine the voltage for a current of 2.5 amps.

d) Write an equation expressing V in terms of I.

e) Use the equation to determine the voltage when the current is 6.2 amps.

f) The resistance (R ohms) is calculated from the equation $V = IR$. State the resistance in this electrical circuit.

Discrete and Continuous Variables

In Class Example #3, the variables I and V are examples of **continuous variables** since they can take on every value within a particular interval, i.e. a variable for which it is possible to find an intermediate value between any two values. For the graph in this example, the current can take on any value between 0 and 5.

In Class Example #2, the variables P and T can only take on limited values (in this case whole number values) and are therefore NOT continuous variables. Such variables are called **discrete variables**.

A graph relating two discrete variables consists of a series of unconnected points, whereas in the graph of two continuous variables the points would be connected.

Classify each of the following variables as discrete or continuous.

a) time taken to complete a 100 m sprint

b) number of students who pass Math 10

c) height of students

d) shoe size

Complete Assignment Questions #1 - #12

Assignment

1. Complete the following statements.

a) The first coordinate of an ordered pair is called the _____ coordinate and the second coordinate is called the _____ coordinate.

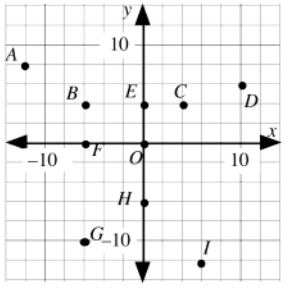
b) _____ _____ are used to locate, or plot, points on a Cartesian Plane.

c) The numbers of an ordered pair are called the _____ of a point on the grid.

d) The x-axis and the y-axis intersect at the _____ .

e) The Cartesian plane is divided into four _____ .

2. The following questions refer to the grid on the right.



a) Name the points represented by the following coordinates.
i) (–6, 4) **ii)** (6, –12) **iii)** (0, 4)

b) List the coordinates of each point.
i) *C* **ii)** *G* **iii)** *F* **iv)** *O* **v)** *H*

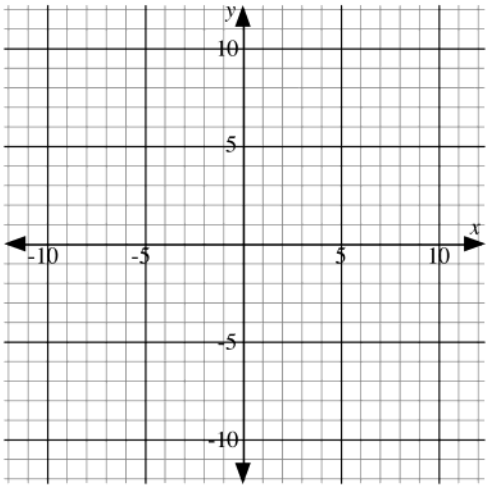
c) Which points are in
i) quadrant 1 **ii)** quadrant 2
iii) quadrant 3 **iv)** quadrant 4

d) Which points are in between quadrants?

e) Which points have the same *x*-coordinate? What visual check can be used?

f) Which points have the same *y*-coordinate? What visual check can be used?

3. The following is a scrambled message using ordered pairs. Plot the ordered pairs on the grid provided. Unscramble the letters, and find the message.
The symbol • represents the beginning of a new letter.



- Join (5, –9) to (5, –5). Join (7, –9) to (5, –7) to (7, –5).
- Join (–11, –2) to (–10, 0) to (–9, 2) to (–8, 0) to (–7, –2). Join (–8, 0) to (–10, 0).
- Join (0, –10) to (0, –6) to (2, –6) to (2, –8) to (0, –8) to (2, –10).
- Join (2, 0) to (0, 0) to (0, –2) to (2, –2) to (2, –4) to (0, –4).
- Join (8, 5) to (8, 9). Join (10, 5) to (10, 9). Join (8, 7) to (10, 7).
- Join (–3, 2) to (–2, 6) to (–1, 4) to (0, 6) to (1, 2).
- Join (3, 8) to (5, 8). Join (4, 8) to (4, 4).
- Join (6, 1) to (4, 1) to (4, –3) to (6, –3).
- Join (–6, –6) to (–6, –10) to (–4, –10) to (–4, –6) to (–6, –6).

Use the following information to answer the next question.

A pattern of L-shapes is shown

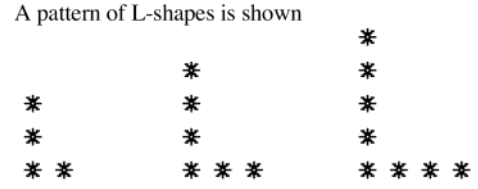


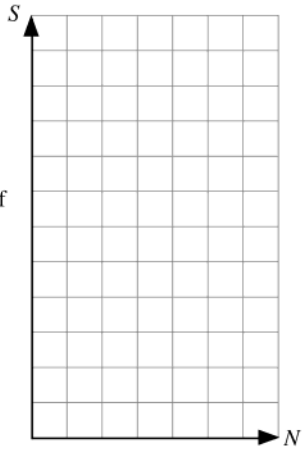
Figure 1 Figure 2 Figure 3

4.a) Draw the next two diagrams in the pattern.

b) Complete the table relating the number of stars, S, to the figure number, N.

Figure Number, N	1	2	3	4	5
Number of Stars, S					

c) Represent the data from the table of values on the grid.



d) Does it make sense to join the points in a straight line? Explain.

e) Describe in words the relationship between the number of stars and the figure number.

f) Write an equation that can be used to determine the number of stars, if we know the figure number.

g) Use the equation to determine the number of stars in figure 43.

h) Use the equation to determine the figure number, if there are 140 stars.

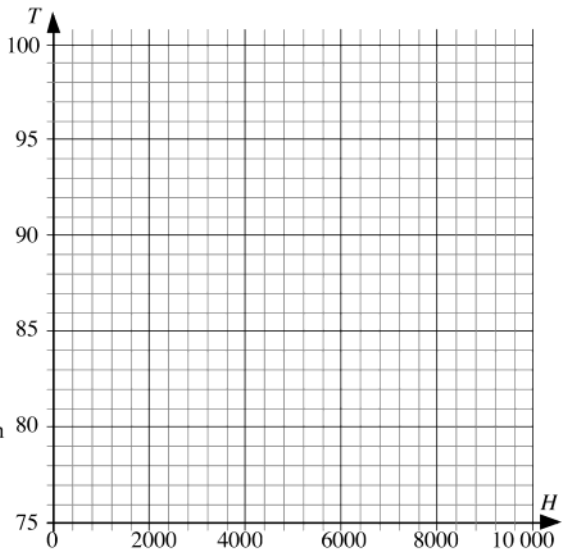
Use the following information to answer the next question.

The boiling point of water varies according to the atmospheric pressure and the height above sea level. The table below shows the approximate boiling temperature of water in $°C$, relating to the height in metres above sea level.

Height Above Sea Level, H	0	2000	4000	6000	8000
Boiling Temperature, T	100	94	88	82	76

5.a) Represent the data from the table on the grid.

b) Does it make sense to join the points together with a straight line? Explain.



c) Use the graph to estimate the boiling temperature of water at a height of 3000 m above sea level.

d) Use the graph to estimate the height above sea level at which the boiling temperature of water is 85°C.

e) The equation relating T and H is $T = 100 - 0.003H$. Use the equation to check the accuracy of your estimates in **c)** and **d)**.

f) In the context of the question, what does the value 100 represent in the equation $T = 100 - 0.003H$?

Use the following information to answer the next question.

A pattern of squares is shown. The length of each side of a square is 1 cm.

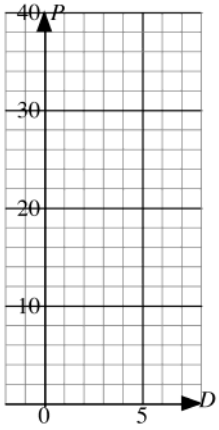
Diagram 1 Diagram 2 Diagram 3

6.a) Draw the next two diagrams in the pattern.

b) Complete the table relating the perimeter of each shape, P, to the diagram number, D.

Diagram Number, *D*	1	2	3	4	5
Perimeter in cm, *P*	8				

c) Represent the data from the table of values on the grid.



d) Does it make sense to join the points in a straight line? Explain.

e) Describe in words the relationship between the perimeter and the diagram number.

f) Write an equation that can be used to determine the perimeter if we know the diagram number.

g) Use the equation to determine the perimeter of diagram 8.

h) Use the equation to determine the diagram number if the perimeter is 56 cm.

7. Describe whether data points should or should not be connected on the graph of a relation in a given situation.

Multiple Choice

8. Which of the following variables is discrete?

A. temperature
B. weight
C. altitude
D. number of goals

9. Which of the following variables is continuous?

A. number of correct answers on a test
B. number of letters in the alphabet
C. number of grams of sugar in a pear
D. number of students in a class

10. Consider the following variables:

i) The age of a truck.
ii) The weight of a truck.
iii) The number of wheels on a truck.
iv) The number of litres of gas in the gas tank of a truck.

Which of the variables above is/are continuous?

A. ii) only
B. i) and ii) only
C. i), ii), and iv) only
D. some other combination of i), ii), iii), and iv)

11. On a Cartesian Plane, the line segment joining the points $(-3,-2)$ and $(5,-5)$

A. intersects both the x-axis and y-axis.
B. intersects the y-axis but not the x-axis.
C. intersects the x-axis but not the y-axis.
D. does not intersect the x-axis or the y-axis.

Numerical Response

12. The relationship between degrees Celsius, C, and degrees Fahrenheit, F, is described by the equation $C = \frac{5}{9}(F - 32)$. The ignition temperature of paper is 451°F.
To the nearest degree, the ignition temperature of paper in degrees Celsius is _____ .

(Record your answer in the numerical response box from left to right)

Answer Key

1. **a)** x y **b)** ordered pairs **c)** coordinates **d)** origin **e)** quadrants

2. **a)** **i)** B **ii)** I **iii)** E
b) **i)** (4, 4) **ii)** (–6, –10) **iii)** (–6, 0) **iv)** (0, 0) **v)** (0, –6)
c) **i)** C, D **ii)** A, B **iii)** G **iv)** I
d) E, F, H, O
e) B, F, G, E, O, H They lie on the same vertical line.
f) B, E, C F, O, They lie on the same horizontal line.

3. MATH ROCKS

4. **a)**

Figure 4 Figure 5

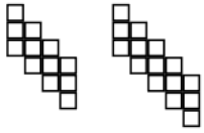
b)

Figure Number, N	1	2	3	4	5
Number of Stars, S	**4**	**6**	**8**	**10**	**12**

d) No, the variables are discrete.
Intermediate values have no meaning.
e) The number of stars is twice the figure number plus two.
f) $S = 2N + 2$ **g)** 88 **h)** 69

5. **b)** Yes. The data is continuous. Intermediate values have meaning.
c) 91 °C **d)** 5 000 m **e)** 91 °C, 5 000 m
f) 100°C is the boiling temperature of water at sea level.

6. **a)** Diagram 4 Diagram 5



b)

Diagram Number, D	1	2	3	4	5
Perimeter in cm, P	**8**	**12**	**16**	**20**	**24**

d) No, the variables are discrete.
Intermediate values have no meaning.
e) The perimeter is 4 more than 4 times the diagram number.
f) $P = 4D + 4$ **g)** 36 cm **h)** Diagram 13

7. If the data is continous, i.e. all intermediate values have meaning, then the data points should be connected.
If the data is discrete, ie not all intermediate points have meaning, then the data points should not be connected.

8. D **9.** C **10.** C **11.** B **12.**

2	3	3	