Developing Conceptual Understanding
of
Number

Set H:
Coordinate
Geometry

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Coordinate Geometry 1

Vocabulary

- *x*-axis
- *y*-axis
- *x*-coordinate
- *y*-coordinate
- coordinate system
- vertical
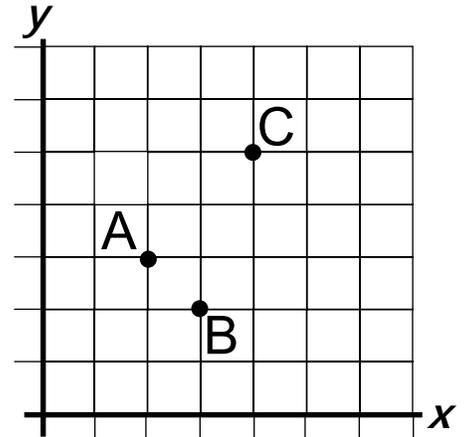- horizontal
- coordinates

Notes

- An *x*-coordinate represents the distance a point is from the vertical or *y*-axis.
- The *y*-coordinate of a point is the distance that point is from the horizontal or *x*-axis.
- An ordered pair is always expressed as the *x*-value first and then the *y*- value. i.e. (*x*,*y*)
- For 2b), watch for the misunderstanding that *c* is larger because it is "higher" than *a*. The reason should involve the distance from the *y*-axis, not the *x*-axis.

Answers

1. a) (3,2)
    b) 3 units
    c) 2 units
    d) Possible Answers
       - The distance a point is from the *x*-axis or the horizontal axis.
       - How far you travel from the *x*-axis in the vertical direction to get to the point.
       - …
    e) 5

2. a) the *y*-coordinate of the point Q or the distance Q is from the *x*-axis.
    b) c, because it represents the *x*-coordinate of a point, Q, which is farther away from the *y*-axis than point P.

Coordinate Geometry 1

1. Use the coordinate system on the right to help answer the following questions:

   a) Give the coordinates for point B.

   b) How far is B from the vertical or *y*-axis?
   -
   c) How far is B from the horizontal or *x*-axis?

   d) If the *x*-coordinate of a point is defined as the distance from the vertical or *y*-axis, define *y*-coordinate.

   e) What is the value of the *y*-coordinate for point C?

- -

2. Use the diagram on the right to help answer the questions:
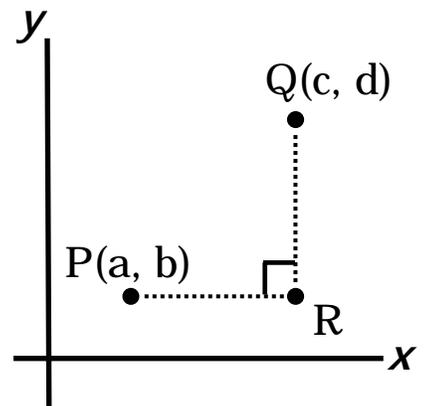
   a) What does "d" represent in the diagram?
   -
   b) From the diagram which is larger: a or c? Why?

Coordinate Geometry 2

Notes

- For 2b), G_1 is a reflection of G and is referred to as "G sub 1"
- For #3, the horizontal distance between two points can be found:
  1. by counting on a sketch or graph
  2. as the difference between the x-coordinates.
- For #3, the vertical distance between two points can be found:
  2. by counting on a sketch or graph
  3. as the difference between the y-coordinates.

Answers

1.   a) R = $(-2,1)$; S = $(3,1)$
   b) x-coordinate
   c) R and S or U and T
   d) 3 units

2.   a) F = $(-3,-1)$
   b) G_1 = $(-2,3)$

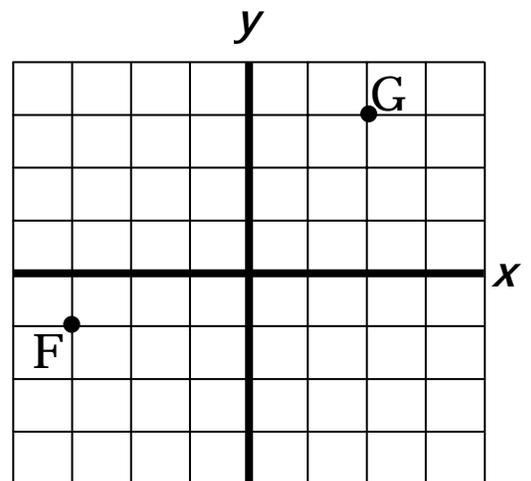3.   horizontal distance = 4 units
   vertical distance = 3 units

Coordinate Geometry 2

1. Use the coordinate system shown to help answer the following questions:
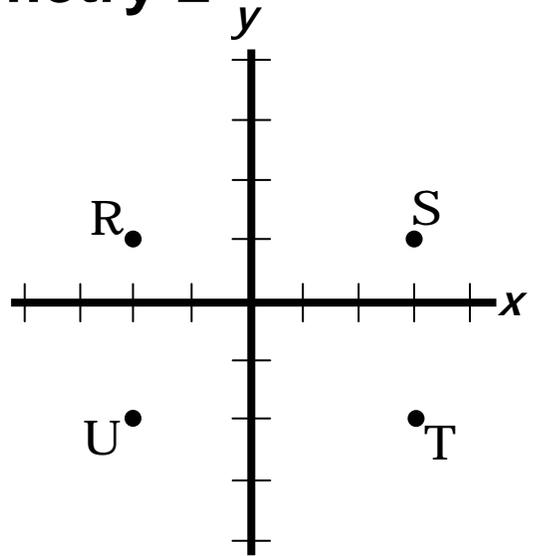
   f) Give the coordinates for both R and S.

   g) Which coordinate is the same for S and T?

   h) Name 2 points with the same *y*-coordinates.

   i) What is the distance between points R and U?

2. Consider points F and G as shown.

   c) What are the coordinates of F?

   d) Reflect G in the *y*-axis to get a new point, G_1. What are the coordinates of G_1?

3. Find the horizontal and vertical distances between A(6,4) and B(2,7)
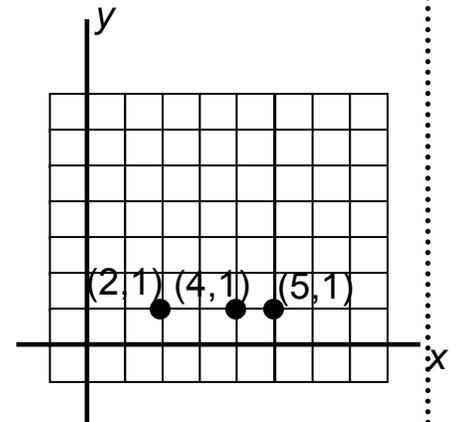
Coordinate Geometry 3

Vocabulary

Notes

- Horizontal points line up horizontally and have the same *y*-coordinate values.
- Vertical points line up vertically and have the same *x*-coordinate values.
- For #1, have a blank Cartesian plane (coordinate grid) available for students to use.

Answers

1. Possible Answers:
    - The points (2,1) , (4,1), and (5,1) are horizontal.
    - These points are horizontal since they are the same distance of 1 unit from the *x*-axis
    - These points all have the same value for their *y*-coordinates.
    - On the graph, the points line up horizontally.

    - …

2. Possible Answers:
   - *y*-coordinate of point B.
    - has the same value as b (ie. d = b)
    - d > f since f is negative
    - d is positive
    - d > a since a is negative
    - d is the distance point B is from the *x*-axis
    - …

Coordinate Geometry 3

1. Give the coordinates for 3 horizontal points. How do you know that your points are horizontal? Explain in two different ways.

- -

2. Points A(a,b) and B(c,d) are horizontal. Points B(c,d) and C(e,f) are vertical.

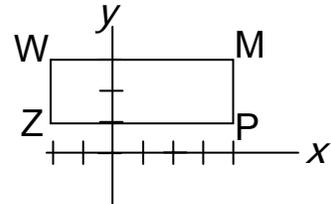   List 3 things you know about "d".
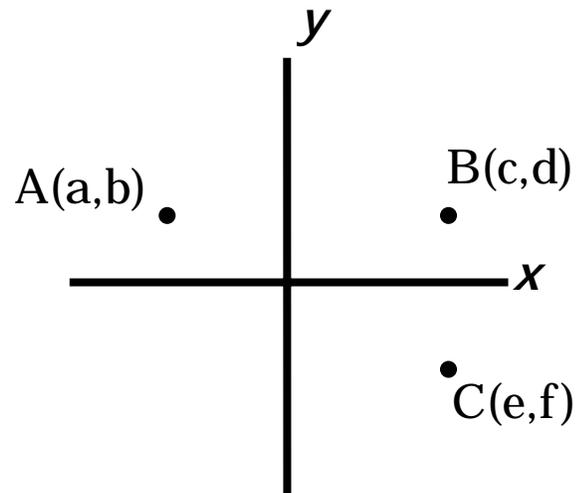
Coordinate Geometry 4

Vocabulary

- ascending
- rectangle
- length
- width

Notes

Answers

1. a) R
    b) $(-3,1)$
    c) 3 units
    d) 5 units
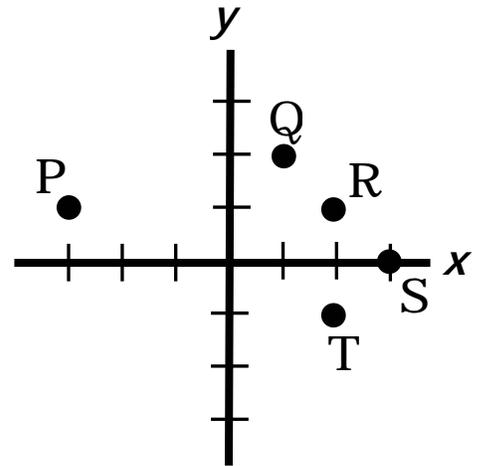   e) P,Q, T, and S

2.

M = $(4,3)$
Z = $(-2,1)$
Length = 6 units (WM)
Width = 2 units (MP)

Coordinate Geometry 4

1. Use the diagram to help answer the following questions:

   j) Which point has coordinates (2,1)?

   k) What are the coordinates of P?

   l) What is the vertical distance between points Q & T?

   m) What is the horizontal distance between P and T?

   n) Arrange points P, S, T, and Q in ascending order of their *x*-coordinates.

2. Consider points W and P as shown. Draw a rectangle WMPZ with opposite sides which are either vertical or horizontal. Find the coordinates for points M and Z. What are the length and width of the sides of rectangle WMPZ?
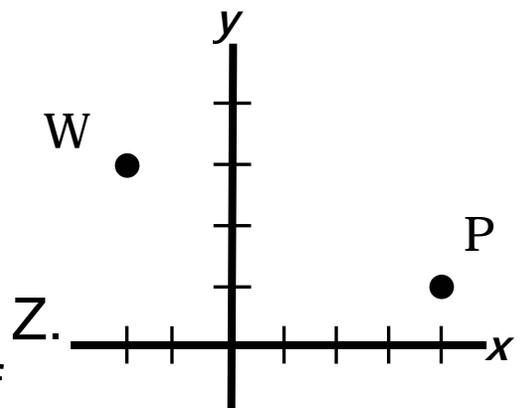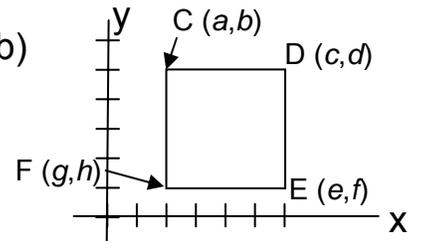
Coordinate Geometry 5

Vocabulary

- vertices
- square

Notes

- For 1b), there are two possible rectangles with F(2,1) and E(6,1):
  - i) C(2,5) and D(6,5)
  - ii) C(2,-3) and D(6,-3)
- The answers to 1b) and 1c) should be consistent.
- For #2, this is an extension of work done in Set C.

Answers

1. a) 4 units   b)

c) Possible Answers:
- x-coordinates of C and F are equal (ie. $a = g$)
- x-coordinates are both positive (ie. $a > 0$ and $g > 0$)
- y-coordinates are both positive (ie. $b > 0$ and $h > 0$)
- b is bigger than h
- $b > h$
- …

2. Possible Answers:
- 2 hundreds, 5 tens and 7 ones
- 2 hundreds and 57 ones
- 257 ones
- 200 + 50 + 7
- 1 hundred, 15 tens and 7 ones
- 1 hundred, 10 tens and 57 ones
- 25 tens and 7 ones
- …

Coordinate Geometry 5

1. Consider a square CDEF with vertices at E(6,1) and F(2,1).
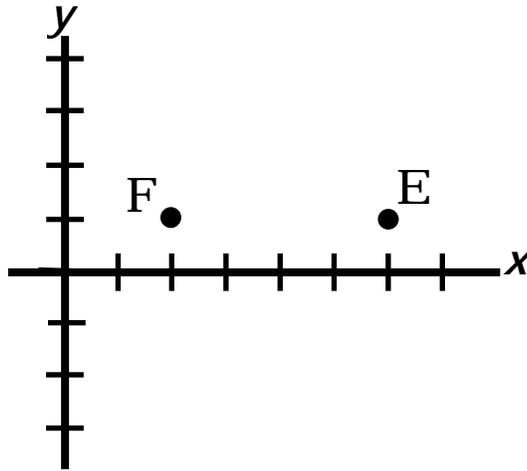
   a)   What is the length of each side of square CDEF?

   b)   Sketch one possible square CDEF.

   c)   What can you say for sure about the coordinates of C and F for your square?

2. Numbers can be expressed using place value in several different ways. For example, 23 can be expressed as 20 + 3, 2 tens and 3 ones, 1 ten and 13 ones, 23 ones, etc.

   Using place value, show 5 different ways to express 257.

Coordinate Geometry 6

Vocabulary

- right angled triangle
- isosceles triangle

Notes

- Points on the *x*-axis have a *y*-coordinate of 0. Similarly, points on the *y*-axis have an *x*-coordinate of 0.
- For #2, have a blank Cartesian plane available for students to use.
- For #2, it is not possible to order the *y*-coordinates since you are not sure what order the points are in.

Answers

1. a) T
   b) (3,0)
   c) P and R
   d) Possible Answers:
      - P, R and T
      - Q, S, and U
      - Q, S, and T
      - R, S and T
      - R, S, and U
   e) 4 units

2. Possible Answers:
   - The *x*-coordinate of B is the same as the *x*-coordinate of A and C. The *y*-coordinate of B is between the *y*-coordinates of A and C.
   - …

3. Possible Answers:
   - (-7, 2)
   - (8,8)
   - (-2,-4)
   - (3,14)
   - $\left(\dfrac{1}{2}, 5\right)$
   - …

Coordinate Geometry 6

1. Use the diagram to help answer
   the following questions:

   o) Which point has coordinates
      (2,-1)?

   p) What are the coordinates of S?

   q) Which 2 points have the same
      value for their *y*-coordinates?

   r) Which 3 points could be joined
      to form a right angled triangle?

   s) What is the horizontal distance between P and U?
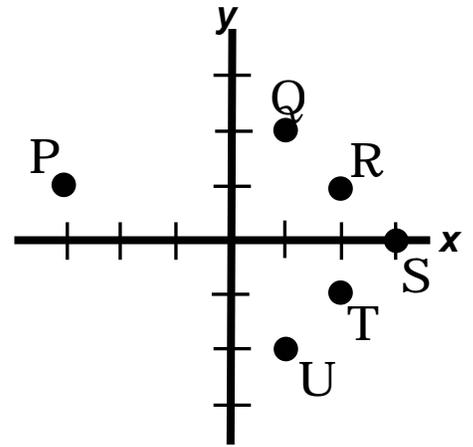
2. Three points A, B, and C lie on a vertical line. B is
   between A and C. What can you say for sure about the
   coordinates of B?

3. An isosceles triangle has 2 equal sides. Draw an
   isosceles △ABC where A is at (3,2) and B is at (-2,8).
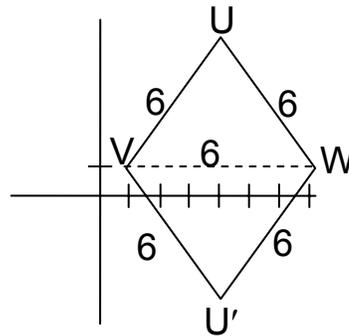   Find coordinates for point C.

Coordinate Geometry 7

Vocabulary

- equilateral triangle

Notes

- ΔU'VW is a reflection over side VW of ΔUVW.
- An equilateral triangle has both equal angles and equal sides.

Answers

1. a)


   b)   Possible Answers:
   - U and U′ must have the same *x*-coordinates.
   - If U has a positive *y*-coordinate, then U′ has a negative *y*-coordinate and vice versa.
   - …

2.   Possible Answers:
   - 2 tens, 5 ones, and 7 hundredths
   - 1 ten, 15 ones and 7 hundredths
   - 25 ones and 7 hundredths
   - 20 + 5 + 0.07
   - 2507 hundredths
   - 2 tens, 50 tenths and 7 hundredths
   - 2 tens and 507 hundredths
   - 24 ones, 10 tenths, and 7 hundredths
   - 24 ones, 9 tenths and 17 hundredths
   - …

Coordinate Geometry 7

1. An equilateral triangle has all sides equal in length. Consider equilateral triangles UVW and U′VW with vertices at V(1,1) and W (7,1).
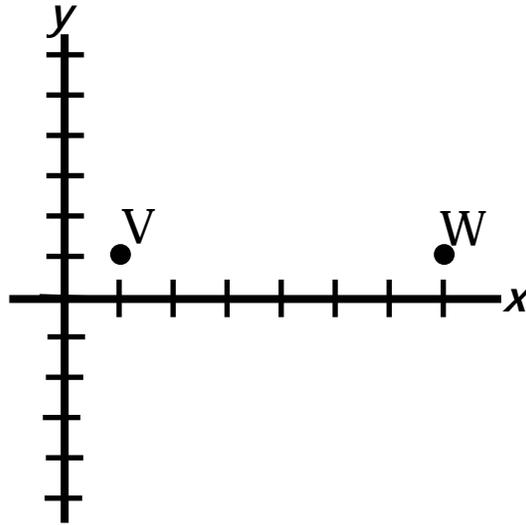
   a) Sketch 2 possible equilateral triangles UVW and U′VW.
   b) From your sketch, what can you say for sure about the coordinates of U and U′?

2. Numbers can be expressed using place value in several different ways. For example, 23 can be expressed as 20 + 3, 2 tens and 3 ones, 1 ten and 13 ones, 23 ones, etc.
   Using place value, show 6 different ways to express 25.07.