

10 January 2019

**7.7 Exam: Similarity ratios, dilation, the tangent function, transformations, symmetry**

1. Given the following two linear equations:

$$l_1 : y = \frac{5}{4}x - 3$$

$$l_2 : 5x + 4y = 8$$

Write down the slopes of the two lines.

$$m_1 =$$

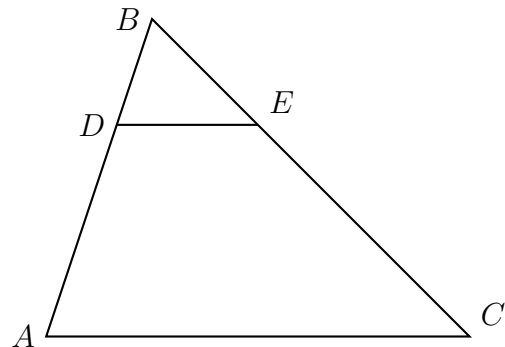
$$m_2 =$$

Are the lines parallel, perpendicular, or neither? Justify your answer using the slopes.

2. Given  $\triangle ABC \sim \triangle DEF$ .  $m\angle A = 88^\circ$  and  $m\angle F = 43^\circ$ . Find the measure of  $\angle C$ .

3. In the diagram below of  $\triangle ABC$ ,  $D$  is a point on  $\overline{BA}$ ,  $E$  is a point on  $\overline{BC}$ , and  $\overline{DE}$  is drawn.

If  $BD = 6.5$ ,  $DA = 13$ , and  $BE = 8$ , what is the length of  $\overline{BC}$  so that  $\overline{AC} \parallel \overline{DE}$ ?



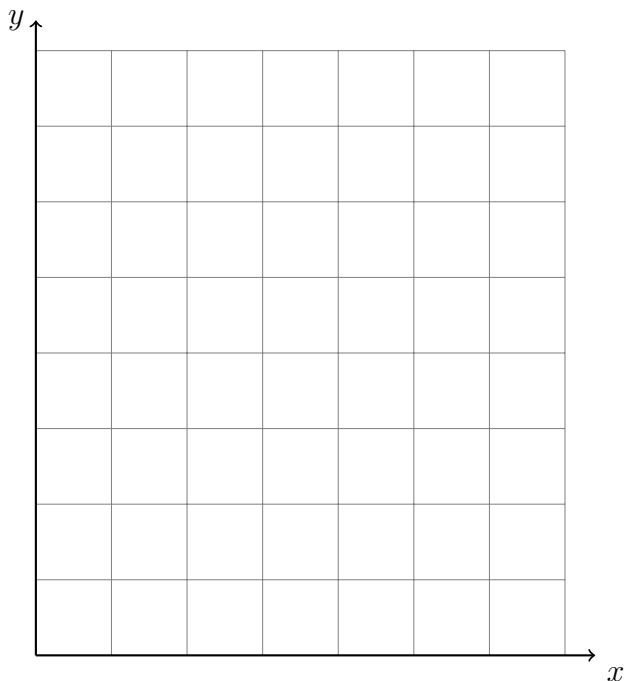
4. Find the image of  $P(3, -5)$  after the translation  $(x, y) \rightarrow (x - 5, y + 8)$ .

5. (a) Graph and label  $\triangle ABC$  with  $A(0, 0)$ ,  $B(5, 6)$ , and  $C(5, 0)$ . Calculate each length:

i.  $AC =$

ii.  $BC =$

iii.  $AB =$



- (b) Write down the equation of the line  $\overleftrightarrow{BC}$ .

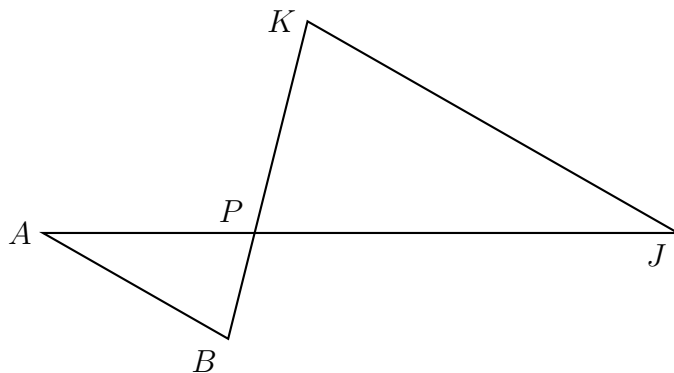
- (c) Write down the equation of the line  $\overleftrightarrow{AB}$ .

- (d) The tangent of an angle is the ratio of the side lengths *opposite* over *adjacent* to the angle. Write down the value as a fraction.

$$\tan \angle BAC =$$

- (e) Find  $m\angle A$  with a calculator's inverse tangent function,  $m\angle BAC = \tan^{-1}\left(\frac{opp}{adj}\right)$

6. Given  $\triangle ABP \sim \triangle JKP$  as shown below.  $AB = 13.5$ ,  $AP = 10.0$ ,  $BP = 9$ , and  $JP = 27.0$ . Find  $JK$ .



7. The line  $l$  has the equation  $y = \frac{3}{2}x + 5$ . To each line below, circle whether  $l$  is parallel, perpendicular, or neither.

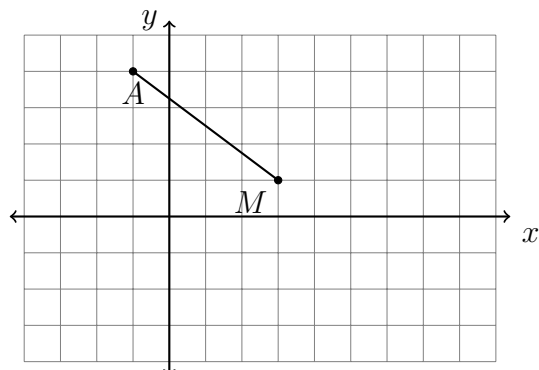
(a) parallel    perpendicular    neither     $y = \frac{3}{2}x - 2$

(b) parallel    perpendicular    neither     $y = \frac{2}{3}x + 7$

(c) parallel    perpendicular    neither     $3x - 2y = -6$

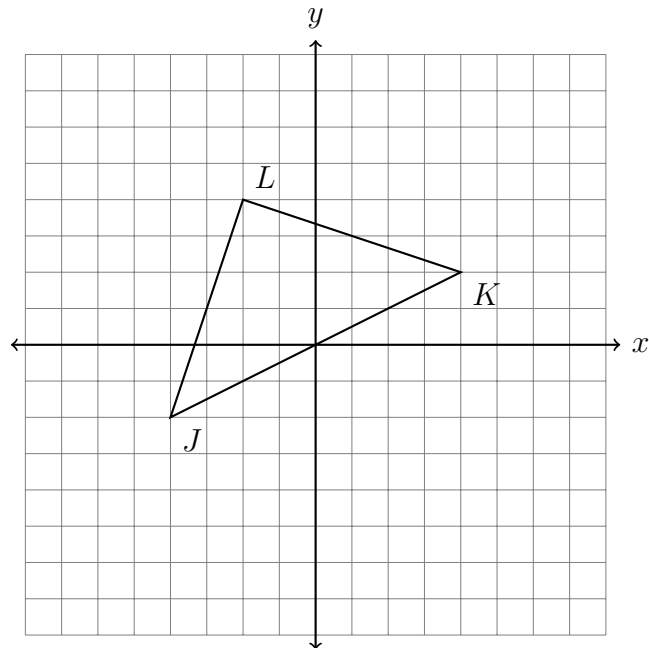
(d) parallel    perpendicular    neither     $2x + 3y = 9$

8.  $A(-1, 4)$  is one endpoint of  $\overline{AB}$ . The segment's midpoint is  $M(3, 1)$ , as shown below. Find the other endpoint,  $B$ .

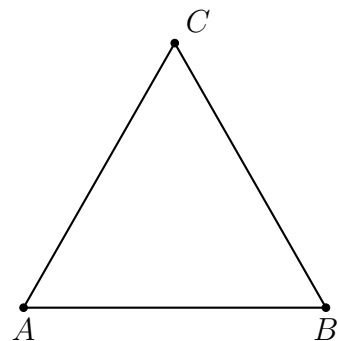


9. The vertices of  $\triangle JKL$  have the coordinates  $J(-4, -2)$ ,  $K(4, 2)$ , and  $L(-2, 4)$ , as shown.

Apply a dilation to  $\triangle JKL \rightarrow \triangle J'K'L'$ , centered on the origin and with a scale factor  $k = 1.5$ . Draw the image  $\triangle J'K'L'$  on the set of axes below, labeling the vertices, and make a table showing the correspondence of both triangles' coordinate pairs.



10. Given isosceles  $\triangle ABC$  with  $\overline{AB} \cong \overline{BC}$ ,  $m\angle A = 53$ . Mark and label the diagram, and then find  $m\angle B$ .  
(the diagram is not to scale)



11. A translation maps  $N(-3, 7) \rightarrow N'(-4, 1)$ . What is the image of  $M(0, -5)$  under the same translation?

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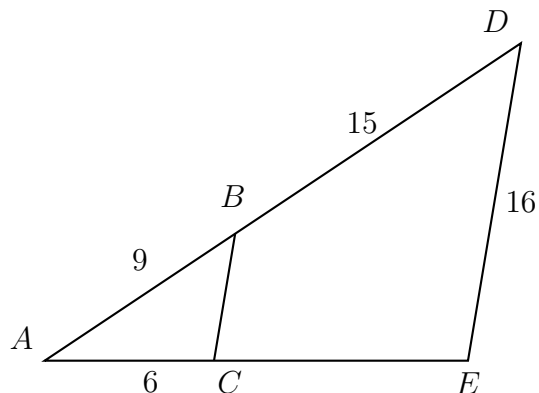
12. A dilation centered at  $A$  maps  $\triangle ABC \rightarrow \triangle ADE$ . Given  $AB = 9$ ,  $AC = 6$ ,  $BD = 15$ , and  $DE = 16$ . Find  $AD$  and the scale factor  $k$ . Then find  $AE$  and  $BC$ .

(a)  $AD =$

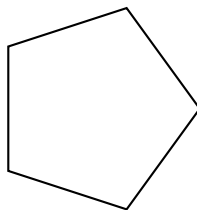
(b)  $k =$

(c)  $AE =$

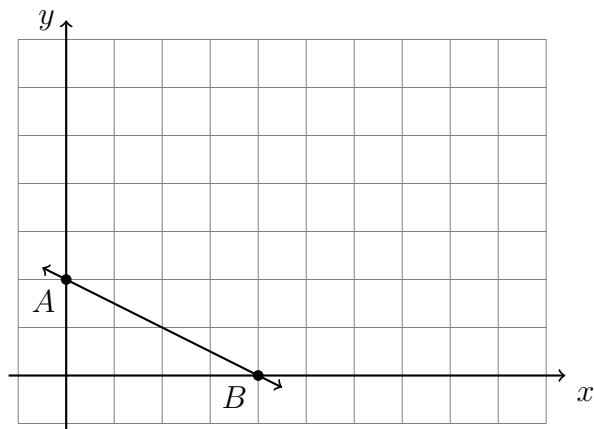
(d)  $BC =$



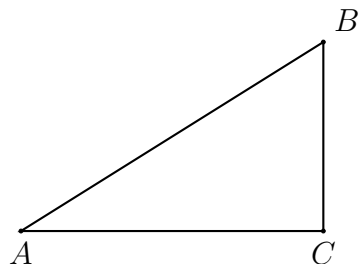
13. What is the smallest non-zero angle of rotation about its center that would map the pentagon onto itself?



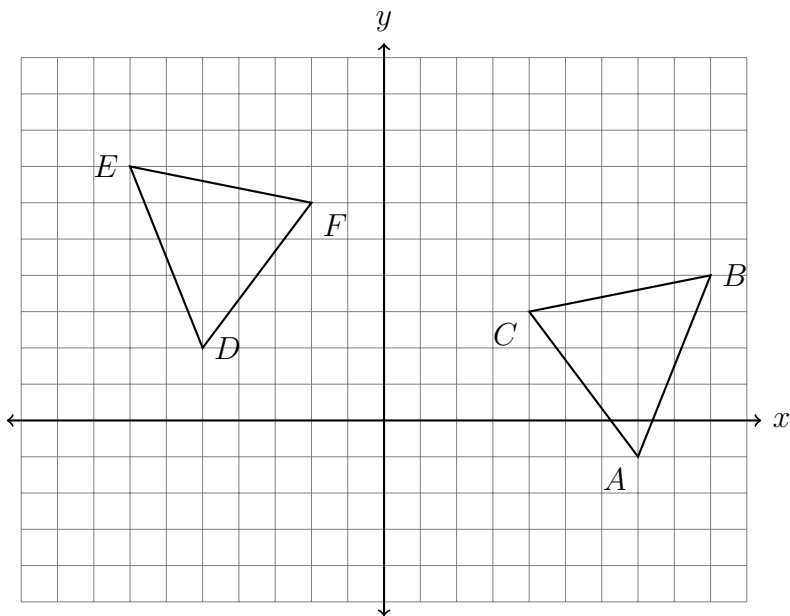
14. The line  $\overleftrightarrow{AB}$  has the equation  $y = -\frac{1}{2}x + 2$ . Apply a dilation mapping  $\overleftrightarrow{AB} \rightarrow \overleftrightarrow{A'B'}$  with a factor of  $k = 2$  centered at the origin. Draw and label the image on the grid. Write the equation of the line  $\overleftrightarrow{A'B'}$ .



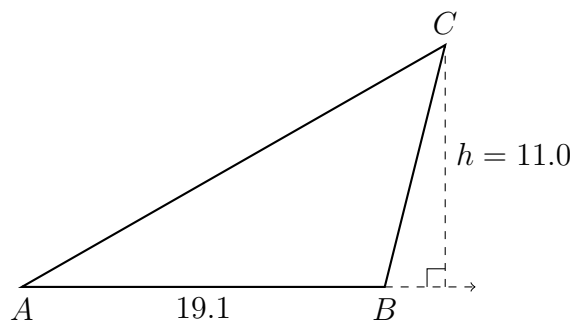
15. Given right  $\triangle ABC$  with  $m\angle C = 90^\circ$ ,  $AC = 13$ ,  $m\angle A = 35^\circ$ . Find  $BC$ , rounded to the nearest tenth.



16. What transformation or series of transformations map  $\triangle ABC$  onto  $\triangle DEF$ , shown below? Fully specify the transformation(s).

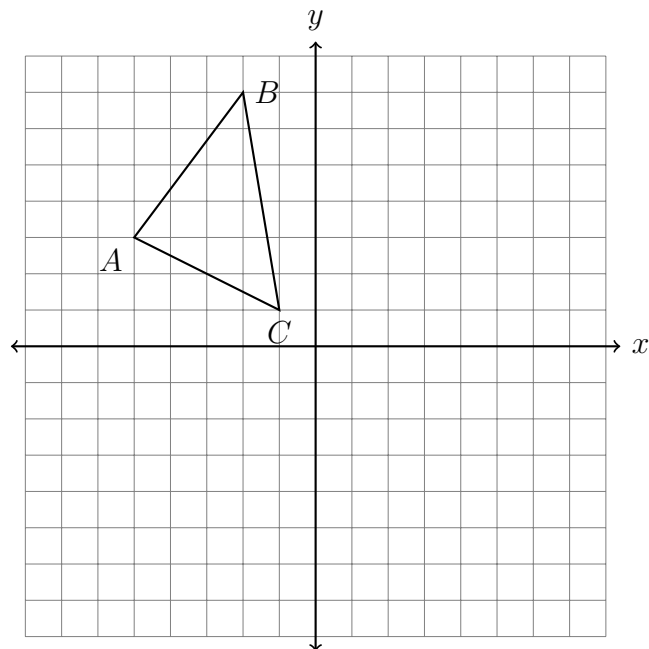


17. The side  $\overline{AB}$  of triangle  $ABC$  is extended and an altitude to the vertex  $C$  is drawn, as shown below. The triangle's height is  $h = 11.0$  and its base measures  $AB = 19.1$ . Find the area of the triangle.



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18. Reflect  $\triangle ABC$  over the  $y$ -axis. Make a table of the coordinates and plot and label the image on the axes.

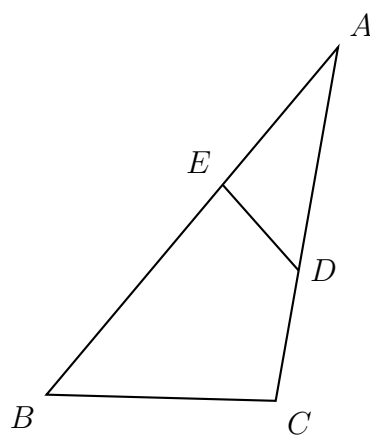


19. The diagram below shows  $\triangle ABC$ , with  $\overline{AEB}$ ,  $\overline{ADC}$ , and  $\angle ACB \cong \angle AED$ .  $AB = 18$ ,  $AD = 12$ ,  $AE = 9$ , and  $DE = 7$ . Find the scale factor  $k$ ,  $AC$ , and  $BC$ .

(a)  $k =$

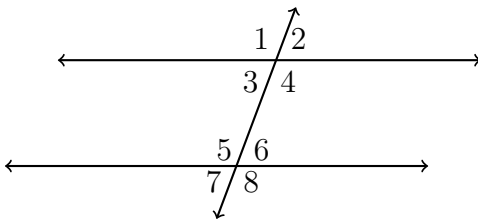
(b)  $AC =$

(c)  $BC =$

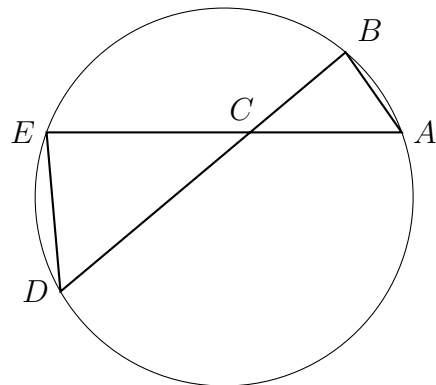


20. Find the midpoint  $M$  of  $\overline{AB}$  with coordinates  $A(-3, 1)$  and  $B(7, 4)$ .

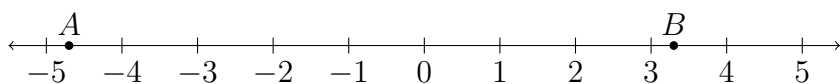
21. Given two parallel lines and a transversal, as shown below. Given  $m\angle 1 = 108$ .



- (a) Find the measure  $m\angle 2$ .
- (b) Find the measure  $m\angle 8$ .
- (c) Given  $m\angle 5 = (6x - 12)^\circ$ . Find  $x$ .
22. In the diagram below, the chords  $\overline{AE}$  and  $\overline{BD}$  intersect at  $C$ . Given  $\triangle ABC \sim \triangle DEC$ ,  $BC = 6$ ,  $CD = 10$ , and  $CE = 8$ . Determine the length of  $\overline{CA}$ .



23. Given two points  $A = -4.7$  and  $B = 3.3$ . Find the value of the midpoint  $M$  between  $A$  and  $B$ , and mark and label it on the numberline below.

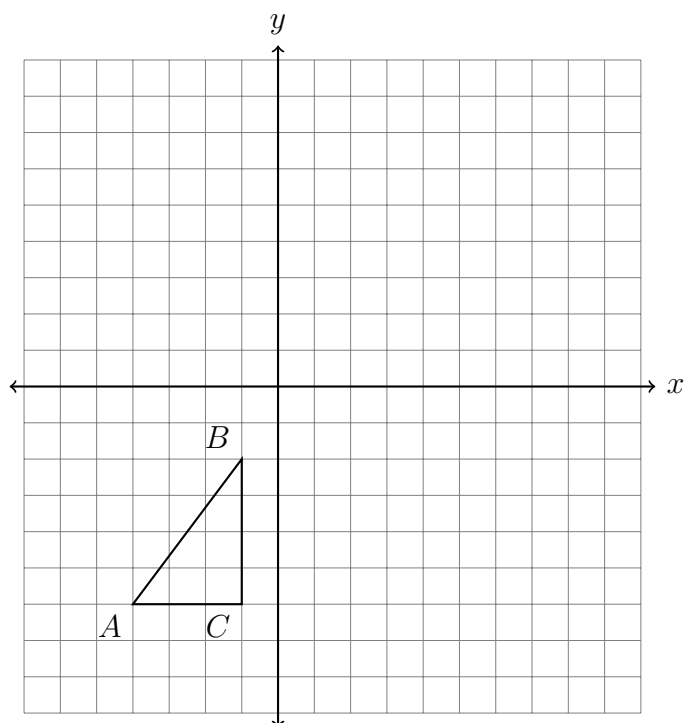




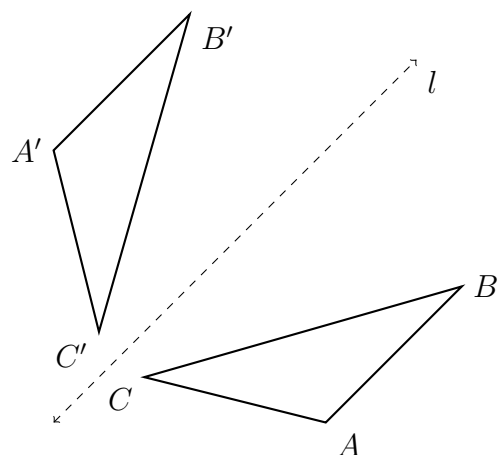
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24. Rotate  $\triangle ABC$   $90^\circ$  counterclockwise around the origin, yielding  $\triangle A'B'C'$ . Then translate it by  $(x, y) \rightarrow (x + 2, y + 7)$ . Make a table of the coordinates showing  $\triangle ABC \rightarrow \triangle A'B'C' \rightarrow \triangle A''B''C''$  and plot and label the images on the axes.



25. The  $\triangle ABC$  is reflected across  $l$  to yield  $\triangle A'B'C'$ .  $AB = 4x + 4$ ,  $A'B' = 7x - 8$ , and  $BC = 5x + 10$ . Find the length  $B'C'$ .



**Using the distance formula to prove an isosceles triangle**

26. In this problem use the following theorem (copy it at the bottom of the page after your calculations):

*A triangle is isosceles if and only two of its sides are congruent.*

Shown below is triangle  $ABC$ ,  $A(-2, 2)$ ,  $B(4, 5)$ , and  $C(-1, 1)$ .

Prove it is an isosceles triangle by

- (a) finding the length of each of the three sides,
- (b) stating which sides are congruent,
- (c) copying the theorem as your conclusion, adding *therefore  $\triangle ABC$  is isosceles.*

