Section 2.2:

Angles Formed by Parallel Lines

Learning Targets (day 2):

1) **Using the known angle properties to solve for unknown angles in a diagram.**

2) **Providing reasons or justifications for the angle measurements we find.**

Angle Pair Classifications

VOA

linear pair

corresp angles

alt int angles

alt ext angles

same-side int angles

- In assessing these types of problems, providing a valid **reason or justification** will be worth as many marks as determining the correct answer.

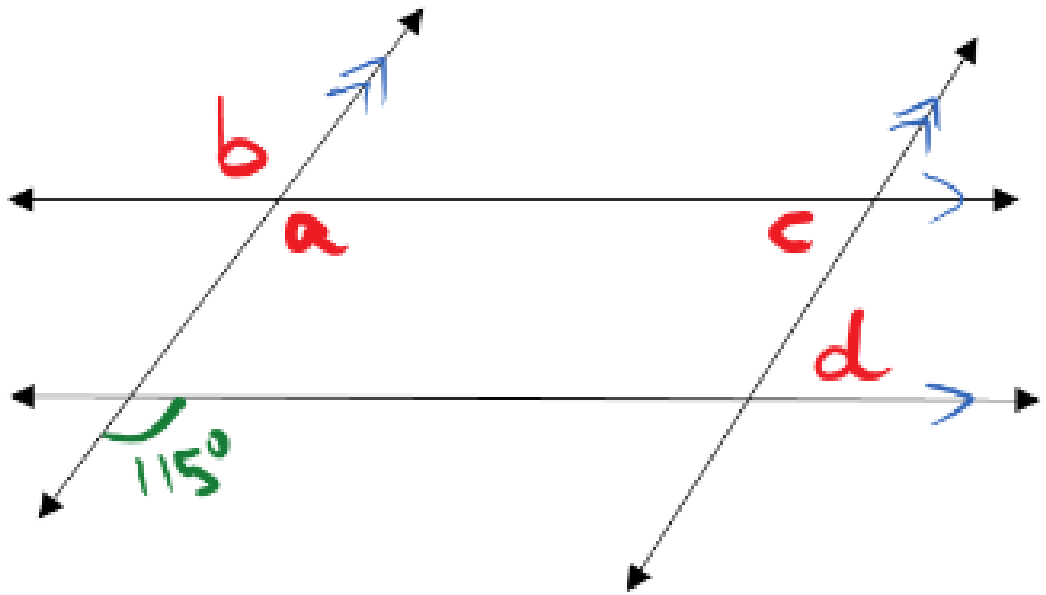
- The reason or justification must include reference to the appropriate **angle pair classification** that allows you to use a mathematical relationship.

- When multiple angles are to be found, you may find them in any order, but you should always **list them in the order you find them**.

- Once an angle measure has been determined, it can then be used to find other angles.

Example #1:

Determine the measures of a, b, c and d and give justifications.



a* =** _____ ***Reason: _____

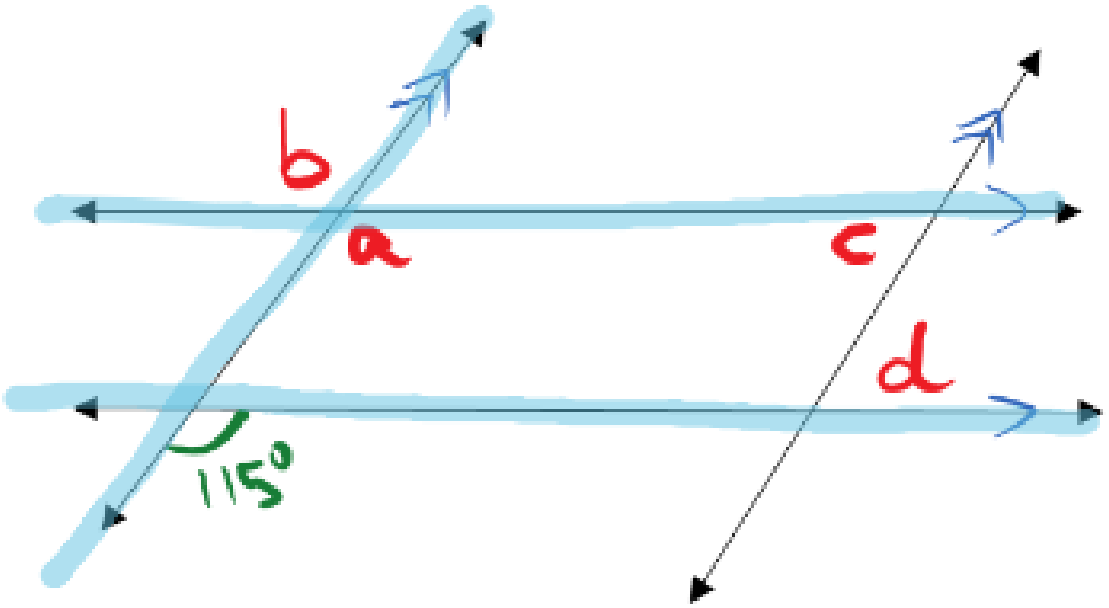
b* =** _____ ***Reason: _____

c* =** _____ ***Reason: _____

d* =** _____ ***Reason: _____

Example #1:

Determine the measures of a, b, c and d and give justifications.



a = 115° **Reason:** _____

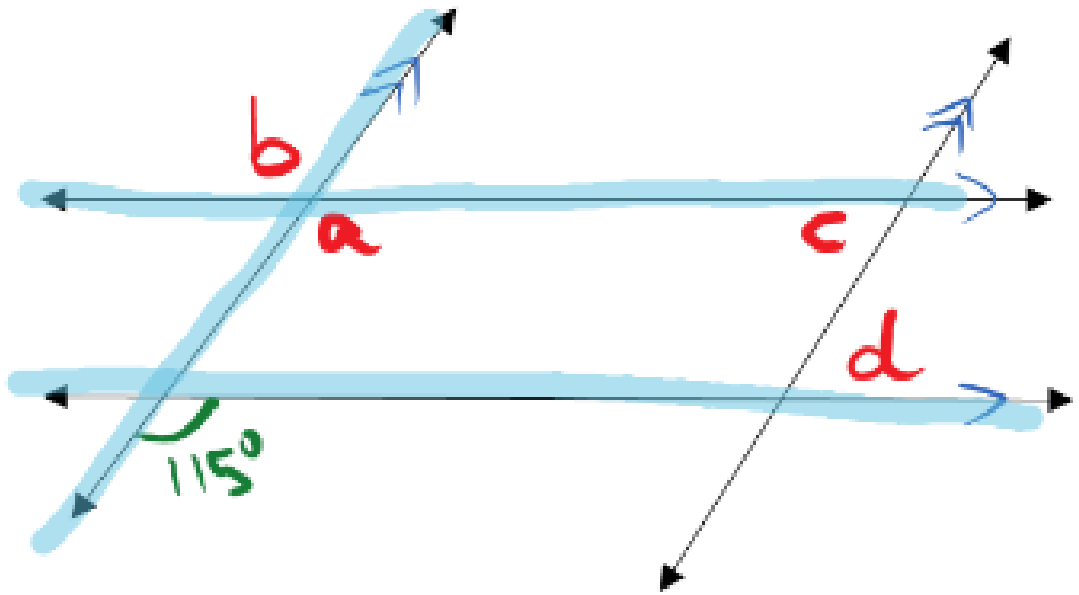
b = _____ **Reason:** _____

c = _____ **Reason:** _____

d = _____ **Reason:** _____

Example #1:

Determine the measures of a, b, c and d and give justifications.



a = 115° **Reason:** ∠*a* and 115° are corresp ∠s

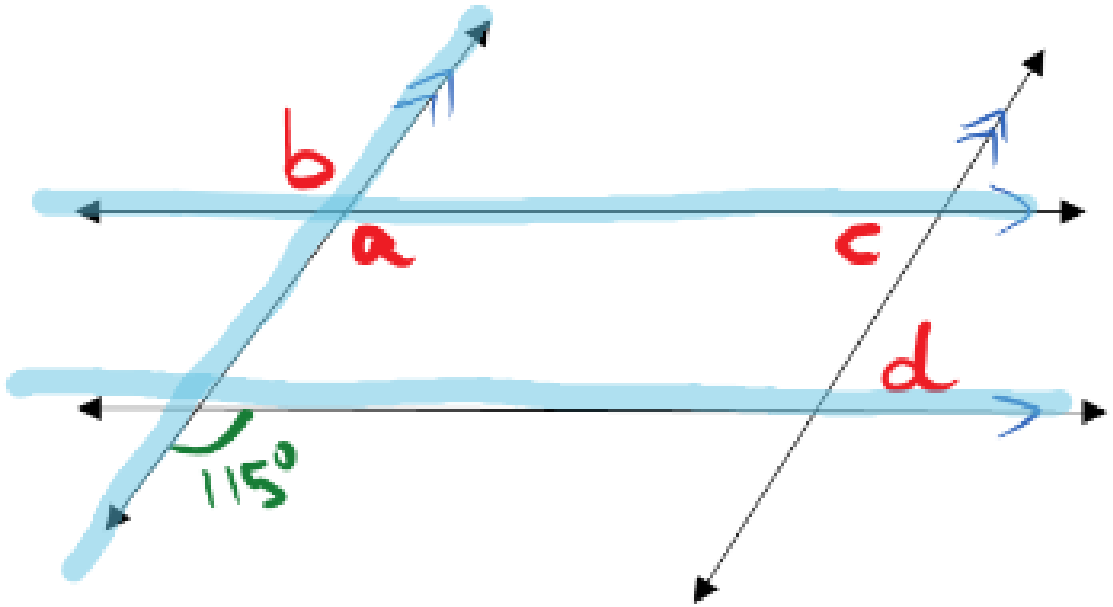
b = _____ **Reason:** _____

c = _____ **Reason:** _____

d = _____ **Reason:** _____

Example #1:

Determine the measures of a, b, c and d and give justifications.



a = 115° **Reason:** ∠*a* and 115° are corresp ∠s

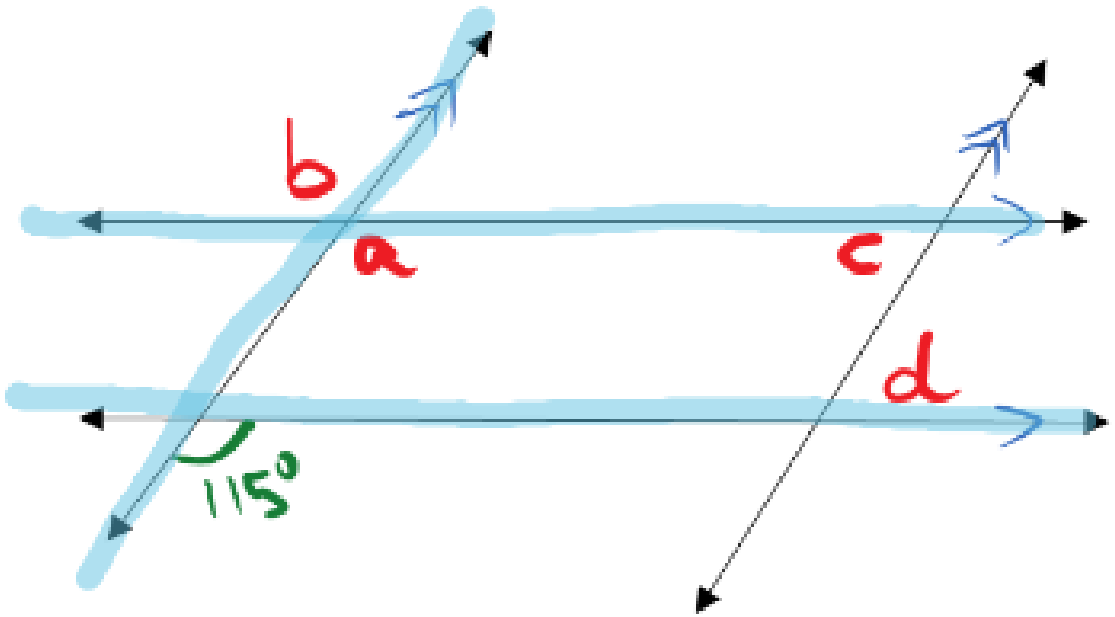
b = 115° **Reason:** _____

c = _____ **Reason:** _____

d = _____ **Reason:** _____

Example #1:

Determine the measures of a, b, c and d and give justifications.



a = 115° **Reason:** $\angle a$ and 115° are corresp $\angle$s

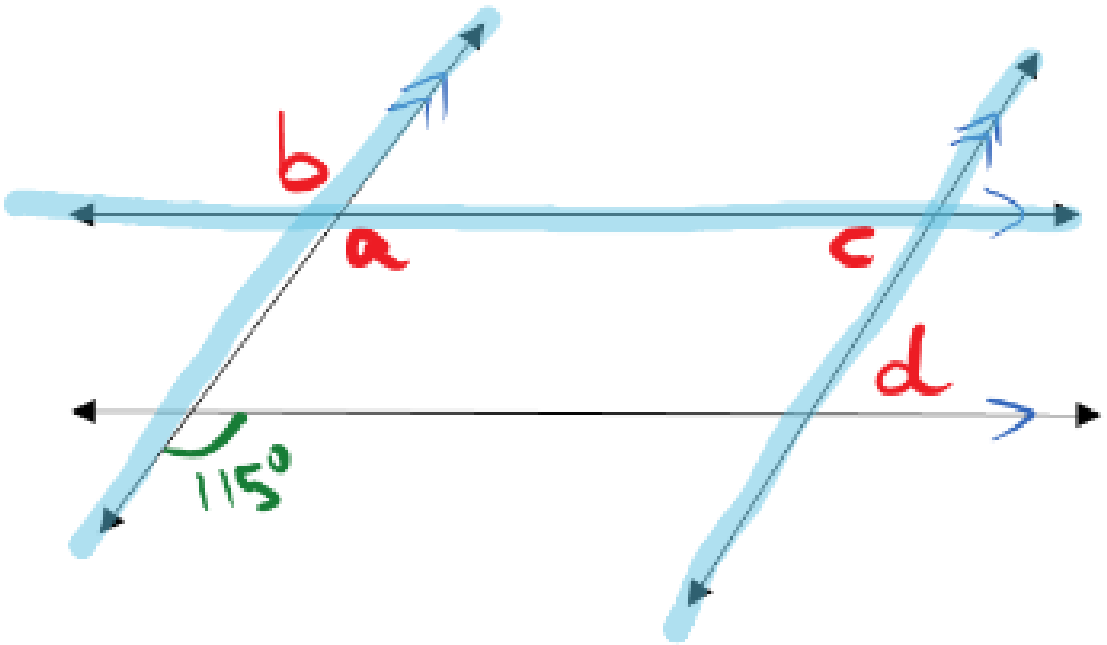
b = 115° **Reason:** $\angle b$ and 115° are alt ext $\angle$s

c = _____ **Reason:** _____

d = _____ **Reason:** _____

Example #1:

Determine the measures of a, b, c and d and give justifications.



a = 115° **Reason:** $\angle a$ and 115° are corresp $\angle$s

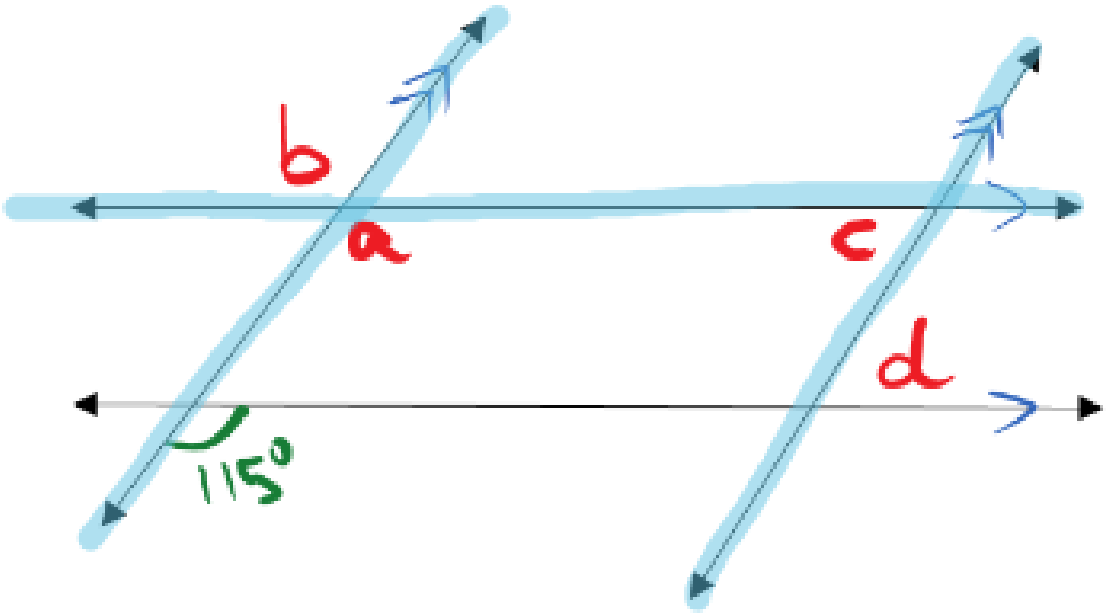
b = 115° **Reason:** $\angle b$ and 115° are alt ext $\angle$s

c = 65° **Reason:** _____

d = _____ **Reason:** _____

Example #1:

Determine the measures of a, b, c and d and give justifications.



a = 115° **Reason:** $\angle a$ and 115° are corresp $\angle$s

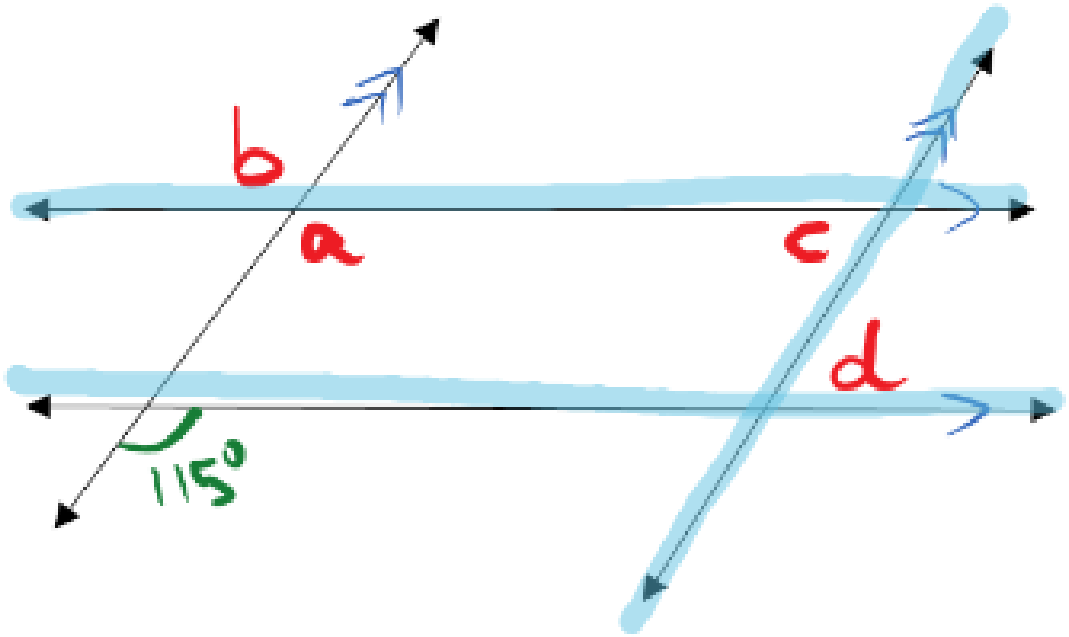
b = 115° **Reason:** $\angle b$ and 115° are alt ext $\angle$s

c = 65° **Reason:** $\angle a$ and $\angle c$ are same-side int $\angle$s

d = _____ **Reason:** _____

Example #1:

Determine the measures of a, b, c and d and give justifications.



a = 115° **Reason:** ∠a and 115° are corresp ∠s

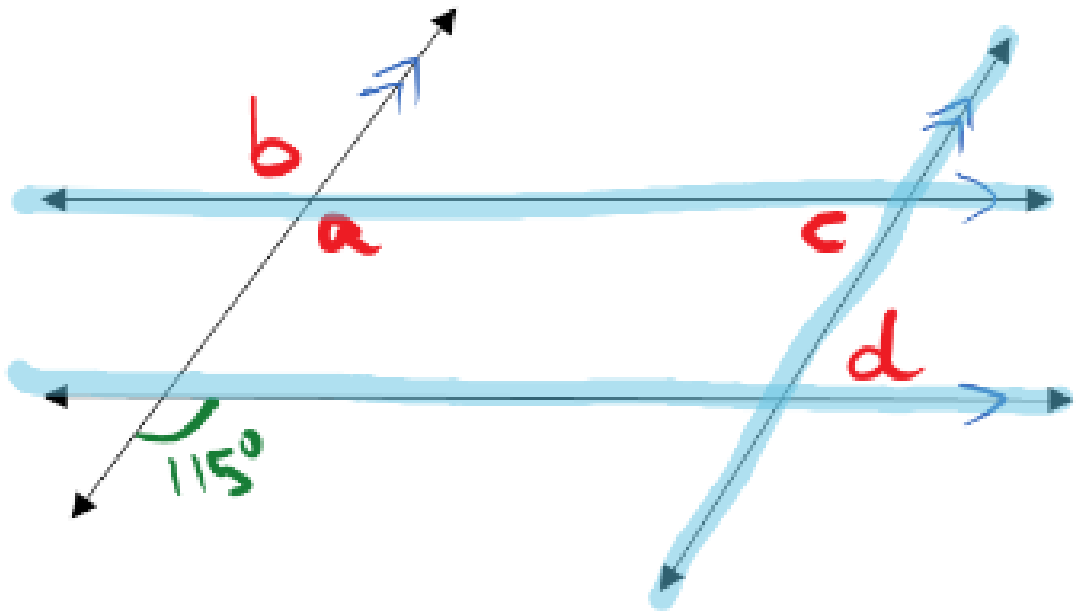
b = 115° **Reason:** ∠b and 115° are alt ext ∠s

c = 65° **Reason:** ∠a and ∠c are same-side int ∠s

d = 65° **Reason:** _____

Example #1:

Determine the measures of a, b, c and d and give justifications.



a = 115° **Reason:** $\angle a$ and 115° are corresp $\angle$s

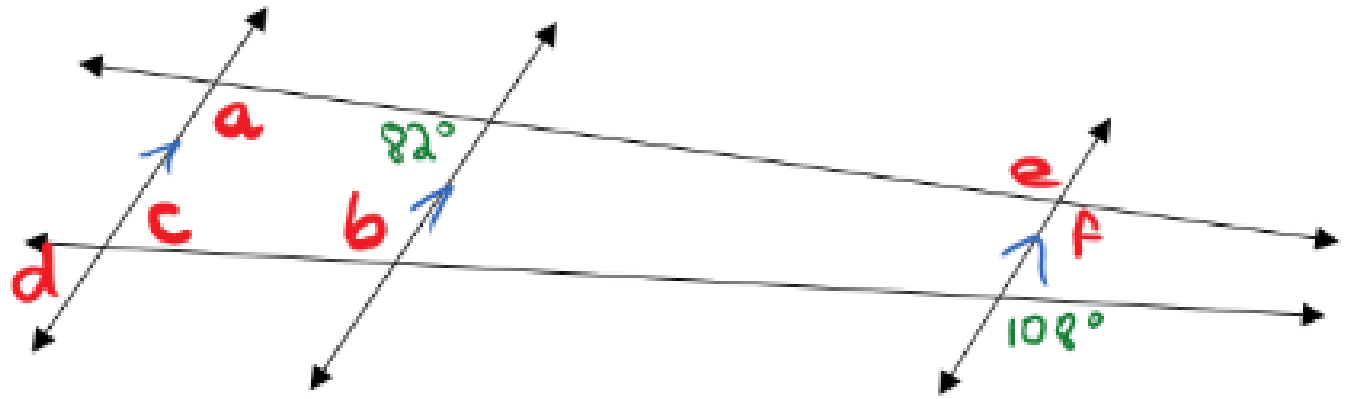
b = 115° **Reason:** $\angle b$ and 115° are alt ext $\angle$s

c = 65° **Reason:** $\angle a$ and $\angle c$ are same-side int $\angle$s

d = 65° **Reason:** $\angle c$ and $\angle d$ are alt int $\angle$s

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



a = _____ **Reason:** _____

b = _____ **Reason:** _____

c = _____ **Reason:** _____

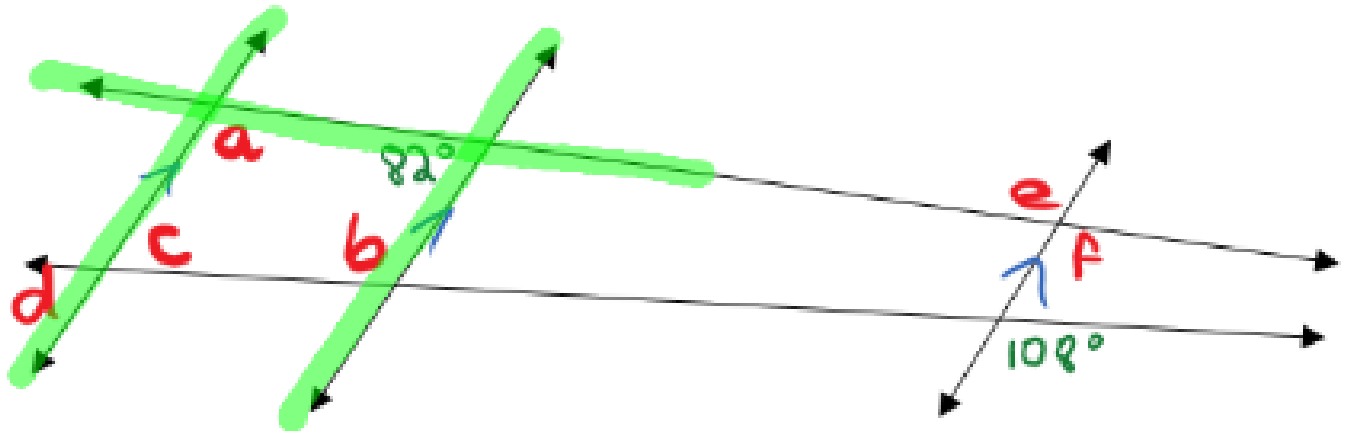
d = _____ **Reason:** _____

e = _____ **Reason:** _____

f = _____ **Reason:** _____

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



a = _____ **Reason:** _____

b = _____ **Reason:** _____

c = _____ **Reason:** _____

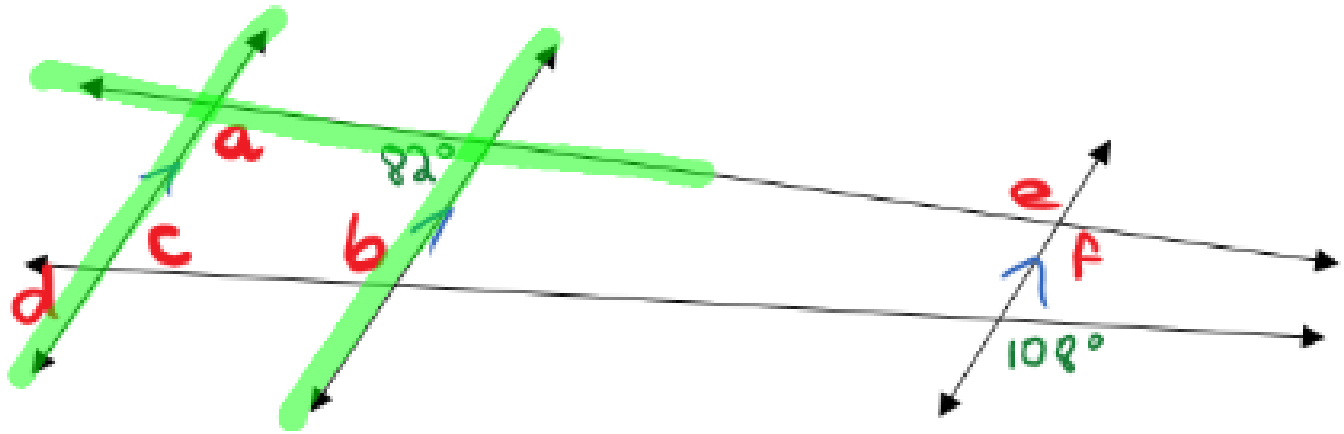
d = _____ **Reason:** _____

e = _____ **Reason:** _____

f = _____ **Reason:** _____

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



a = 98° *Reason:* _____

b = _____ *Reason:* _____

c = _____ *Reason:* _____

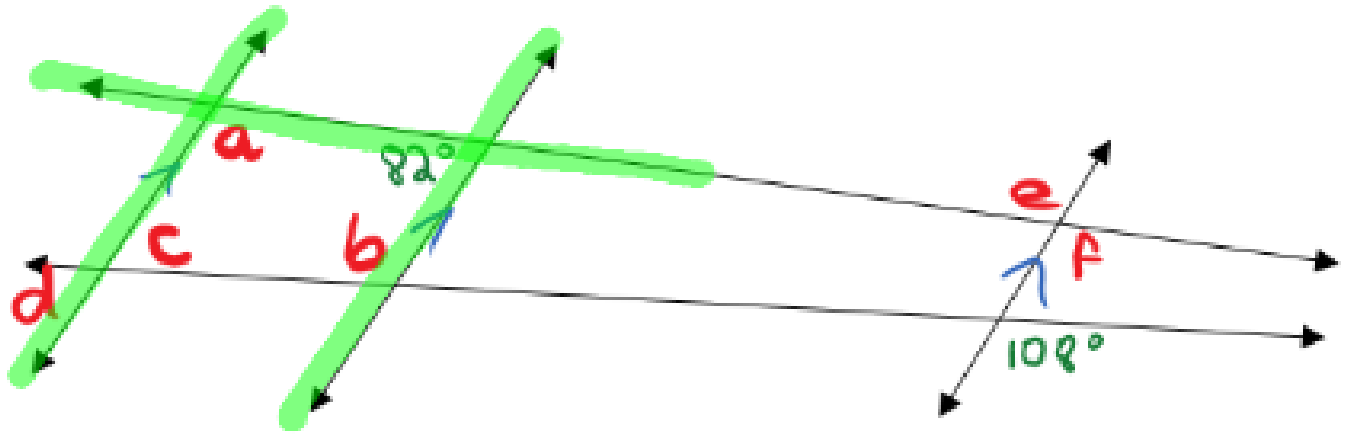
d = _____ *Reason:* _____

e = _____ *Reason:* _____

f = _____ *Reason:* _____

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



a = 98° **Reason:** $\angle a$ and 82° are ss int $\angle$s

b = _____ **Reason:** _____

c = _____ **Reason:** _____

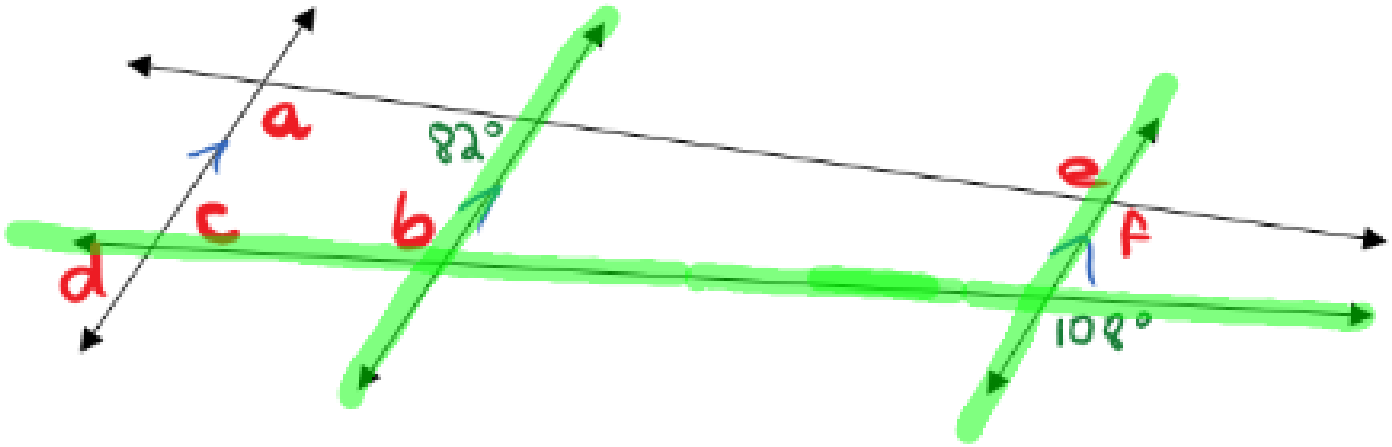
d = _____ **Reason:** _____

e = _____ **Reason:** _____

f = _____ **Reason:** _____

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



a = 98° **Reason:** $\angle a$ and 82° are ss int $\angle$s

b = _____ **Reason:** _____

c = _____ **Reason:** _____

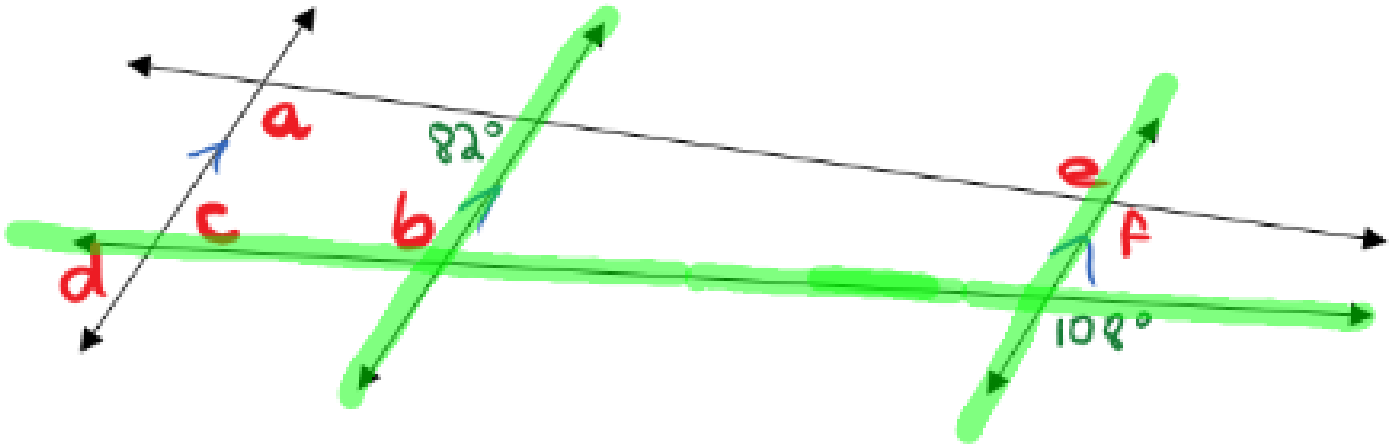
d = _____ **Reason:** _____

e = _____ **Reason:** _____

f = _____ **Reason:** _____

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



a = 98° *Reason:* ∠*a* and 82° are ss int ∠s

b = 108° *Reason:* _____

c = _____ *Reason:* _____

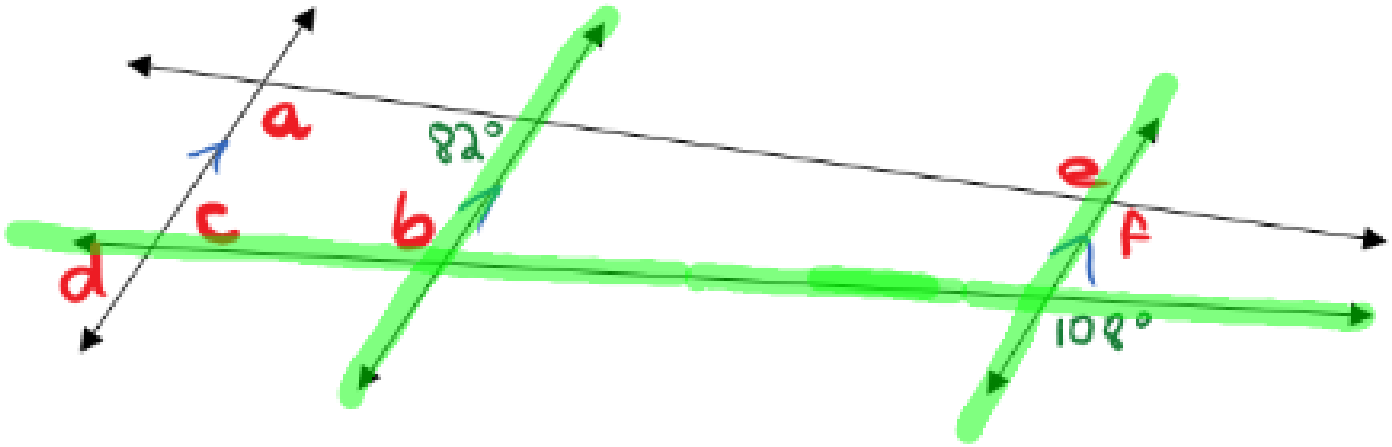
d = _____ *Reason:* _____

e = _____ *Reason:* _____

f = _____ *Reason:* _____

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



a = 98° *Reason:* $\angle a$ and $82°$ are ss int $\angle$s

b = 108° *Reason:* $\angle b$ and $108°$ are alt ext $\angle$s

c = _____ *Reason:* _____

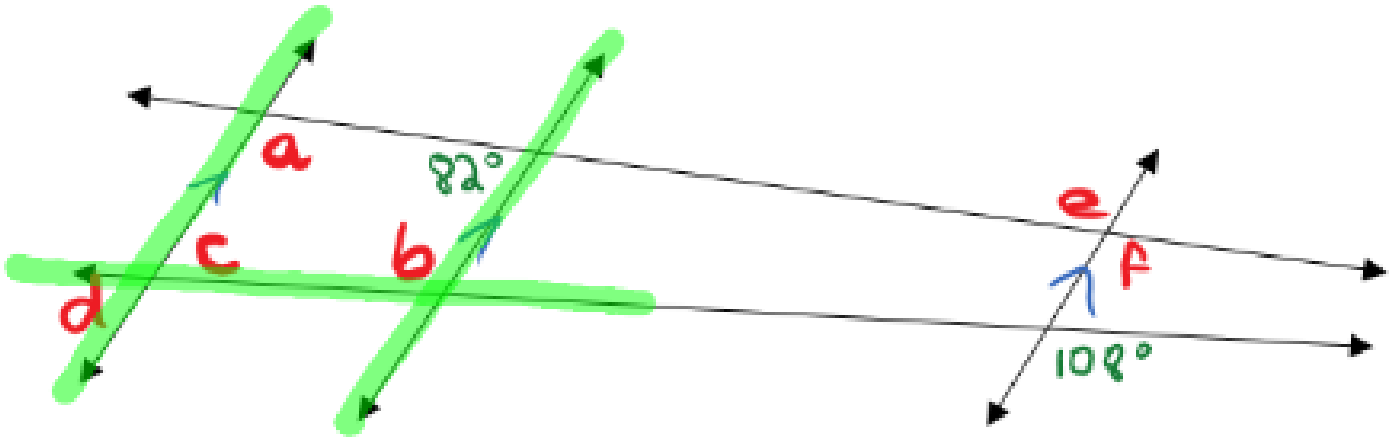
d = _____ *Reason:* _____

e = _____ *Reason:* _____

f = _____ *Reason:* _____

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



a = 98° *Reason:* $\angle a$ and 82° are ss int ∠s

b = 108° *Reason:* $\angle b$ and 108° are alt ext ∠s

c = _____ *Reason:* _____

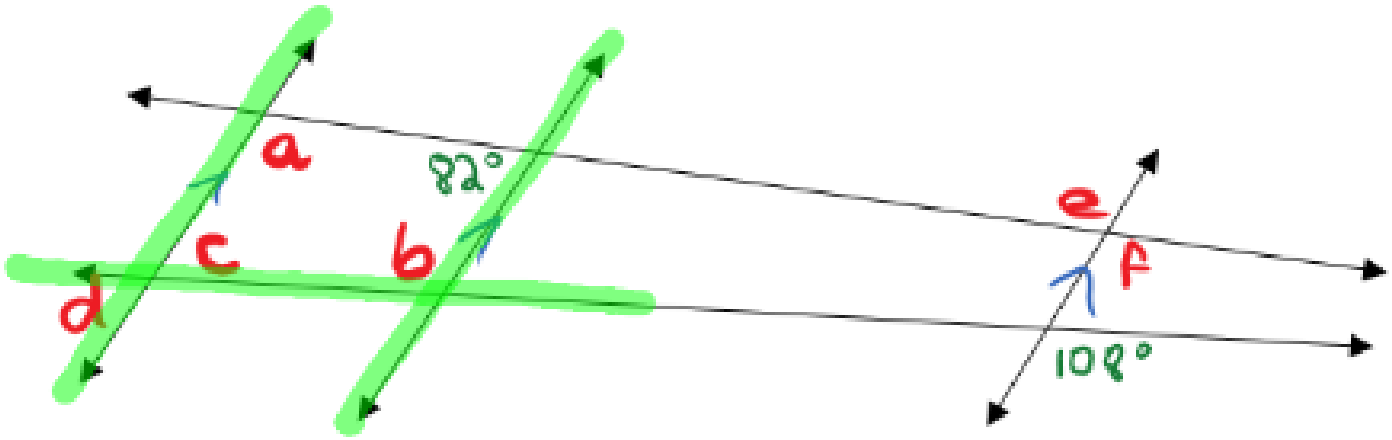
d = _____ *Reason:* _____

e = _____ *Reason:* _____

f = _____ *Reason:* _____

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



a = 98° *Reason:* $\angle a$ and $82°$ are ss int $\angle$s

b = 108° *Reason:* $\angle b$ and $108°$ are alt ext $\angle$s

c = 72° *Reason:* _____

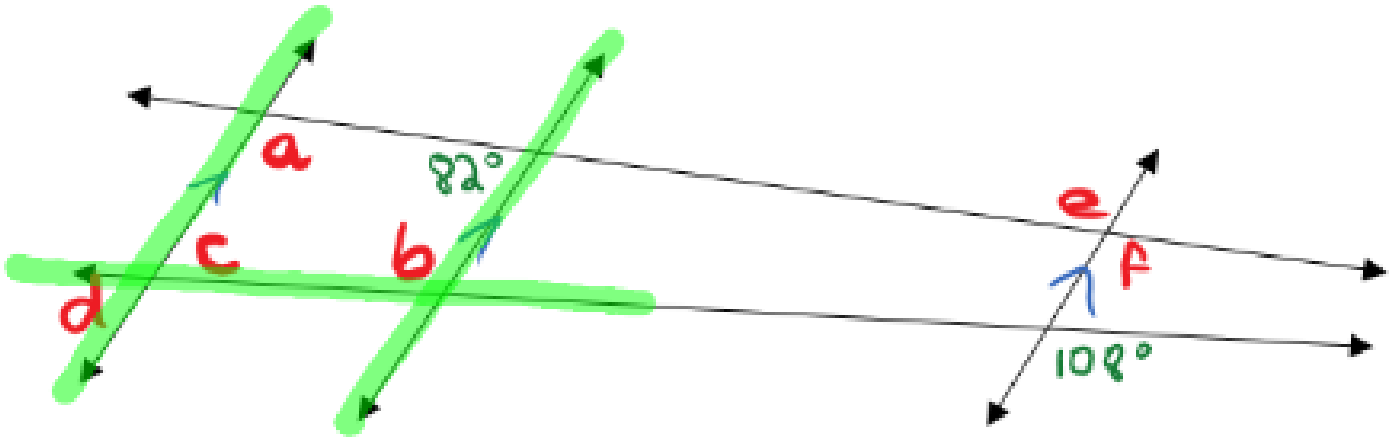
d = _____ *Reason:* _____

e = _____ *Reason:* _____

f = _____ *Reason:* _____

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



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b = 108° **Reason:** $\angle b$ and $108°$ are alt ext $\angle$s

c = 72° **Reason:** $\angle c$ and $\angle b$ are ss int $\angle$s

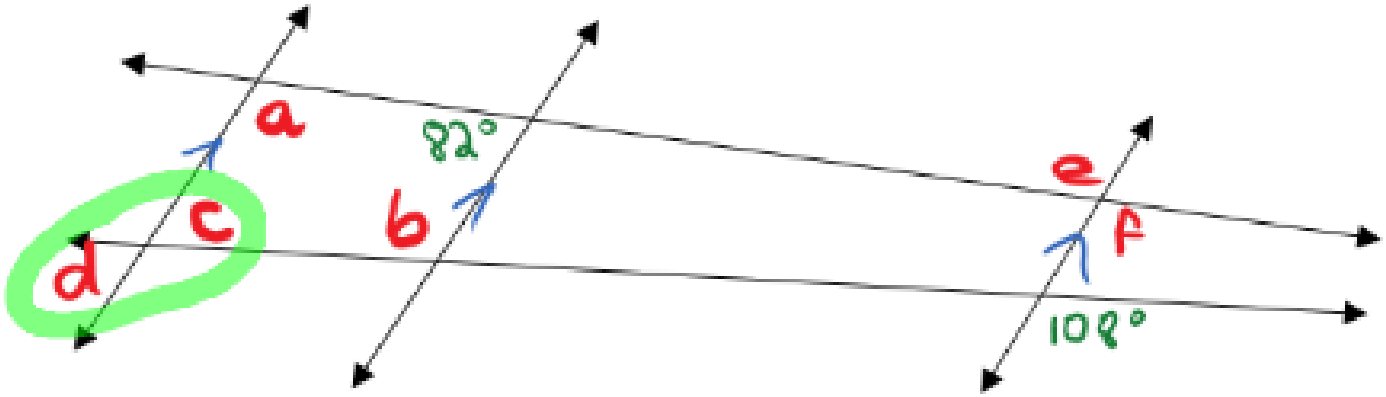
d = _____ **Reason:** _____

e = _____ **Reason:** _____

f = _____ **Reason:** _____

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



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b = 108° *Reason:* $\angle b$ and $108°$ are alt ext $\angle$s

c = 72° *Reason:* $\angle c$ and $\angle b$ are ss int $\angle$s

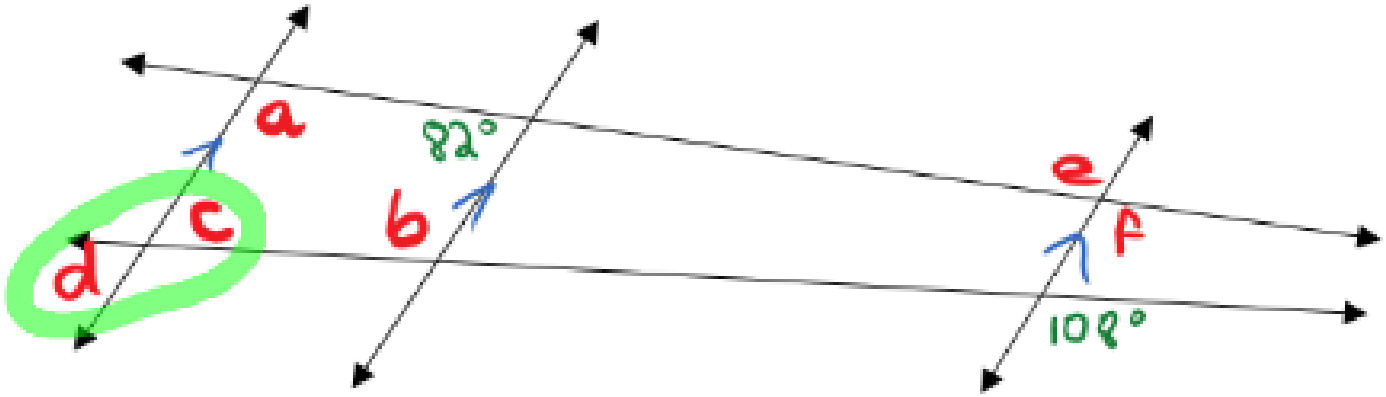
d = _____ *Reason:* _____

e = _____ *Reason:* _____

f = _____ *Reason:* _____

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



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c = 72° *Reason:* $\angle c$ and $\angle b$ are ss int $\angle$s

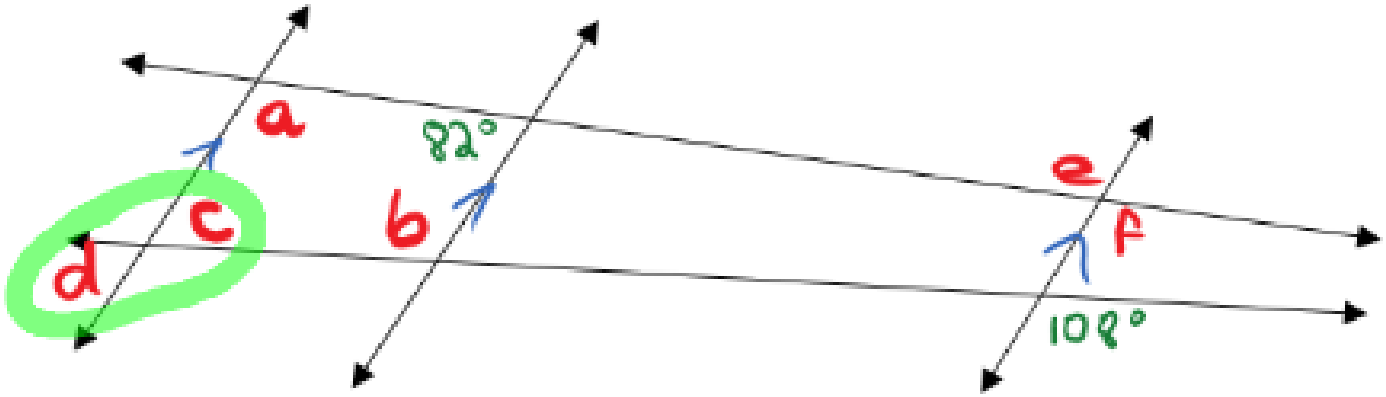
d = 72° *Reason:* _____

e = _____ *Reason:* _____

f = _____ *Reason:* _____

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



a = 98° **Reason:** $\angle a$ and $82°$ are ss int $\angle$s

b = 108° **Reason:** $\angle b$ and $108°$ are alt ext $\angle$s

c = 72° **Reason:** $\angle c$ and $\angle b$ are ss int $\angle$s

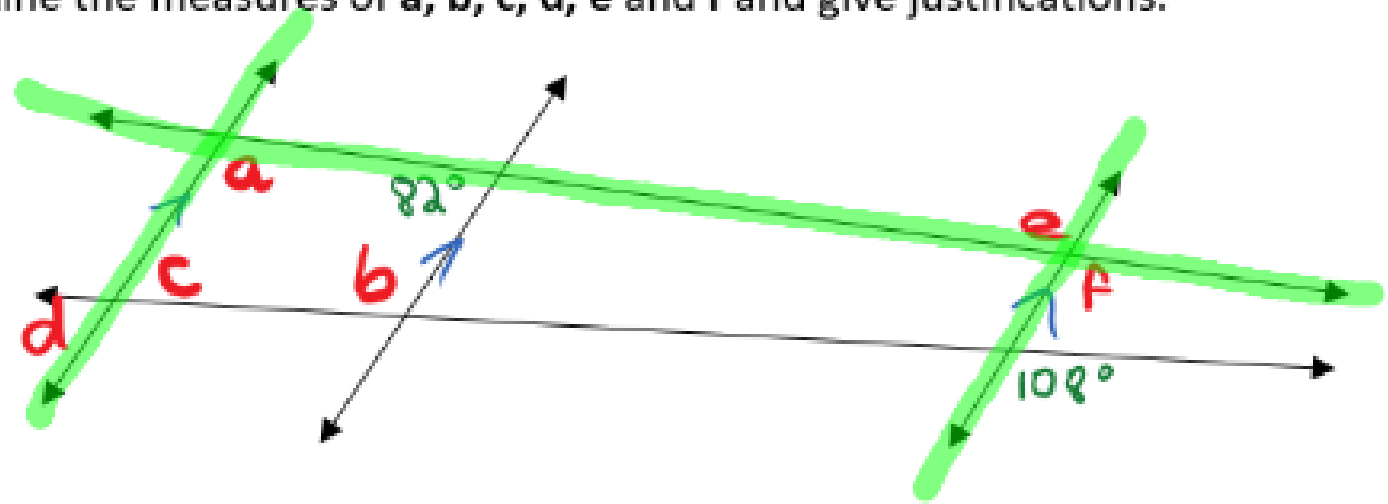
d = 72° **Reason:** $\angle d$ and $\angle c$ are VOA

e = _____ **Reason:** _____

f = _____ **Reason:** _____

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



a = 98° *Reason:* $\angle a$ and $82°$ are ss int $\angle$s

b = 108° *Reason:* $\angle b$ and $108°$ are alt ext $\angle$s

c = 72° *Reason:* $\angle c$ and $\angle b$ are ss int $\angle$s

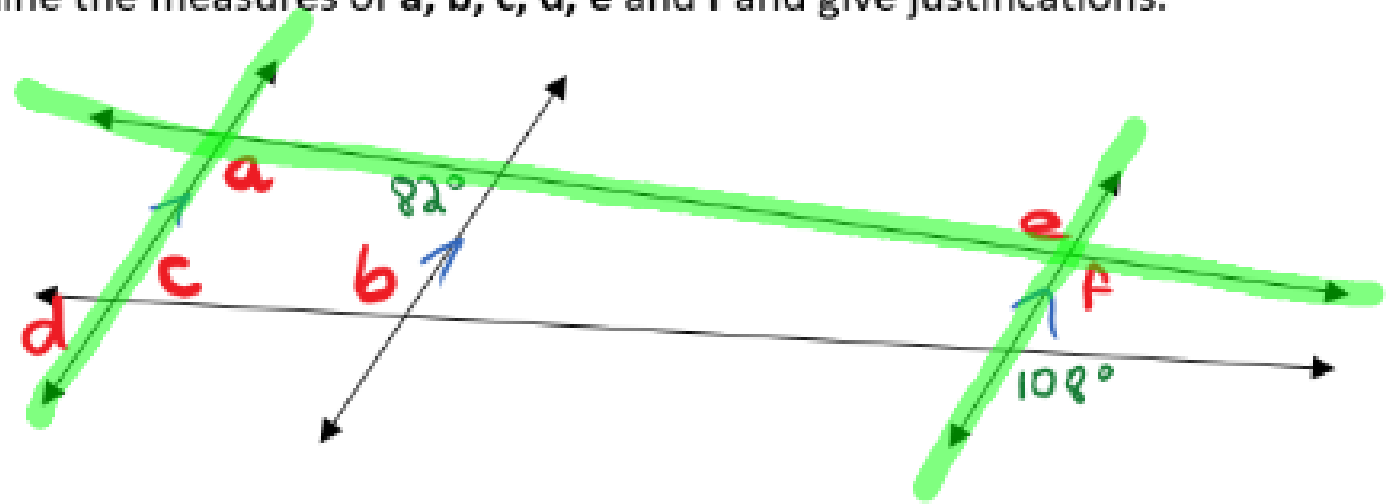
d = 72° *Reason:* $\angle d$ and $\angle c$ are VOA

e = _____ *Reason:* _____

f = _____ *Reason:* _____

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



a = 98° *Reason:* $\angle a$ and $82°$ are ss int $\angle$s

b = 108° *Reason:* $\angle b$ and $108°$ are alt ext $\angle$s

c = 72° *Reason:* $\angle c$ and $\angle b$ are ss int $\angle$s

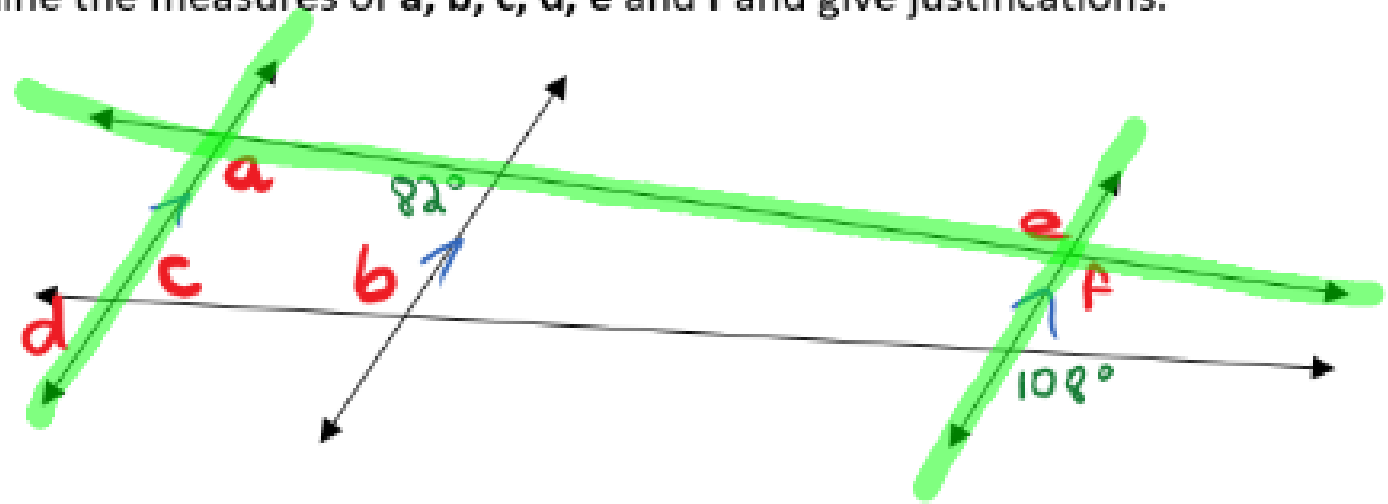
d = 72° *Reason:* $\angle d$ and $\angle c$ are VOA

e = 98° *Reason:* _____

f = _____ *Reason:* _____

Example #2:

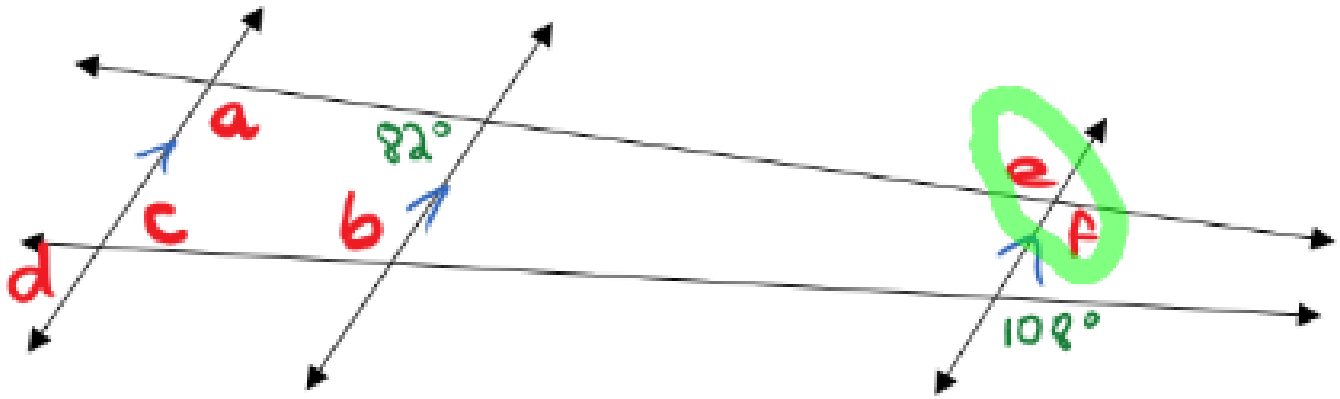
Determine the measures of **a, b, c, d, e** and **f** and give justifications.



a =	98°	*Reason:*	$\angle a$ and $82°$ are ss int $\angle$s
b =	108°	*Reason:*	$\angle b$ and $108°$ are alt ext $\angle$s
c =	72°	*Reason:*	$\angle c$ and $\angle b$ are ss int $\angle$s
d =	72°	*Reason:*	$\angle d$ and $\angle c$ are VOA
e =	98°	*Reason:*	$\angle e$ and $\angle a$ are alt int $\angle$s
f =		*Reason:*	

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.



a = 98° *Reason:* $\angle a$ and 82° are ss int ∠s

b = 108° *Reason:* $\angle b$ and 108° are alt ext ∠s

c = 72° *Reason:* $\angle c$ and $\angle b$ are ss int ∠s

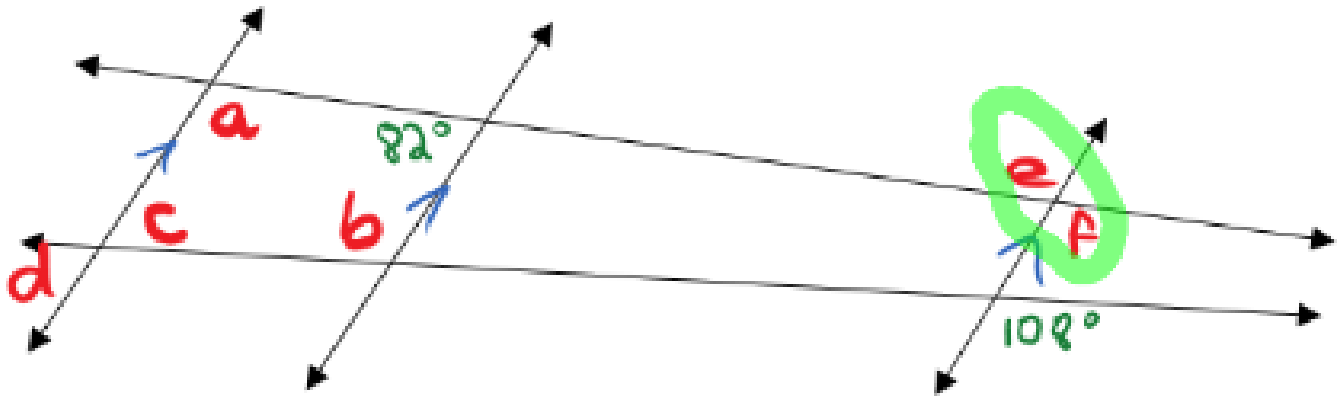
d = 72° *Reason:* $\angle d$ and $\angle c$ are VOA

e = 98° *Reason:* $\angle e$ and $\angle a$ are alt int ∠s

f = _____ *Reason:* _____

Example #2:

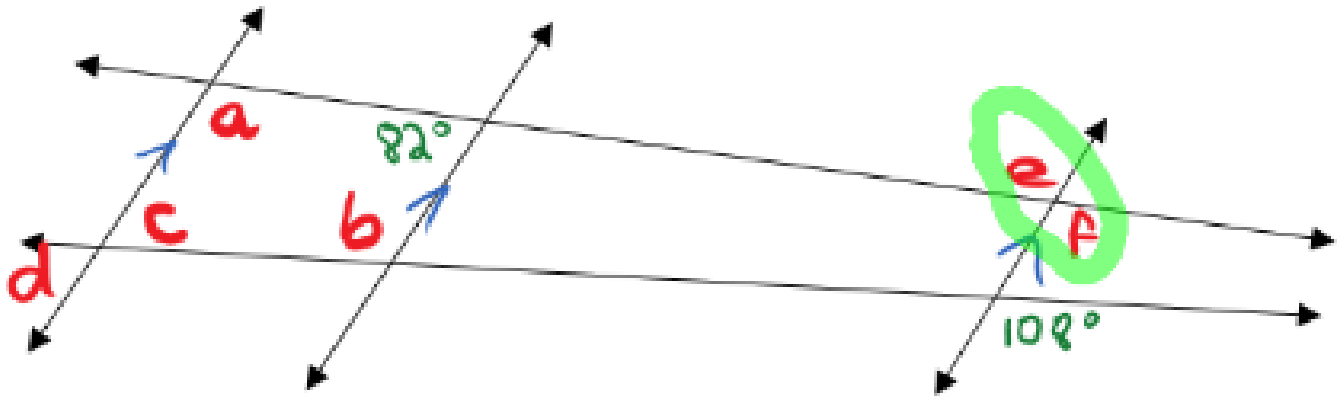
Determine the measures of **a, b, c, d, e** and **f** and give justifications.



a =	98°	*Reason:*	$\angle a$ and 82° are ss int ∠s
b =	108°	*Reason:*	$\angle b$ and 108° are alt ext ∠s
c =	72°	*Reason:*	$\angle c$ and $\angle b$ are ss int ∠s
d =	72°	*Reason:*	$\angle d$ and $\angle c$ are VOA
e =	98°	*Reason:*	$\angle e$ and $\angle a$ are alt int ∠s
f =	98°	*Reason:*	

Example #2:

Determine the measures of **a, b, c, d, e** and **f** and give justifications.

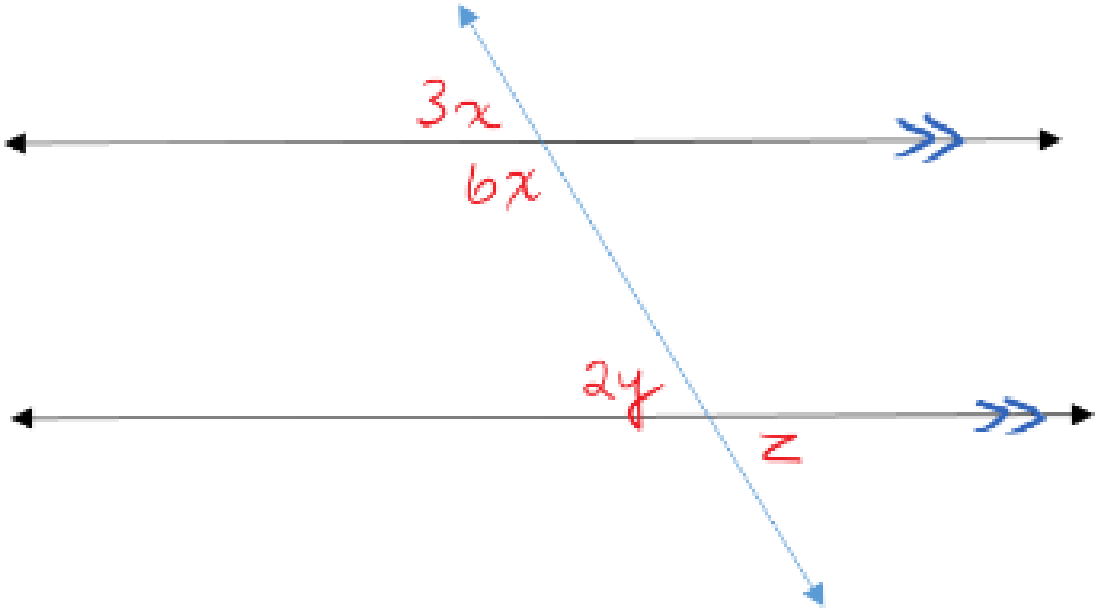


a =	98°	*Reason:*	$\angle a$ and $82°$ are ss int $\angle$s
b =	108°	*Reason:*	$\angle b$ and $108°$ are alt ext $\angle$s
c =	72°	*Reason:*	$\angle c$ and $\angle b$ are ss int $\angle$s
d =	72°	*Reason:*	$\angle d$ and $\angle c$ are VOA
e =	98°	*Reason:*	$\angle e$ and $\angle a$ are alt int $\angle$s
f =	98°	*Reason:*	$\angle f$ and $\angle e$ are VOA

Using angle relationships to solve for the value of variables

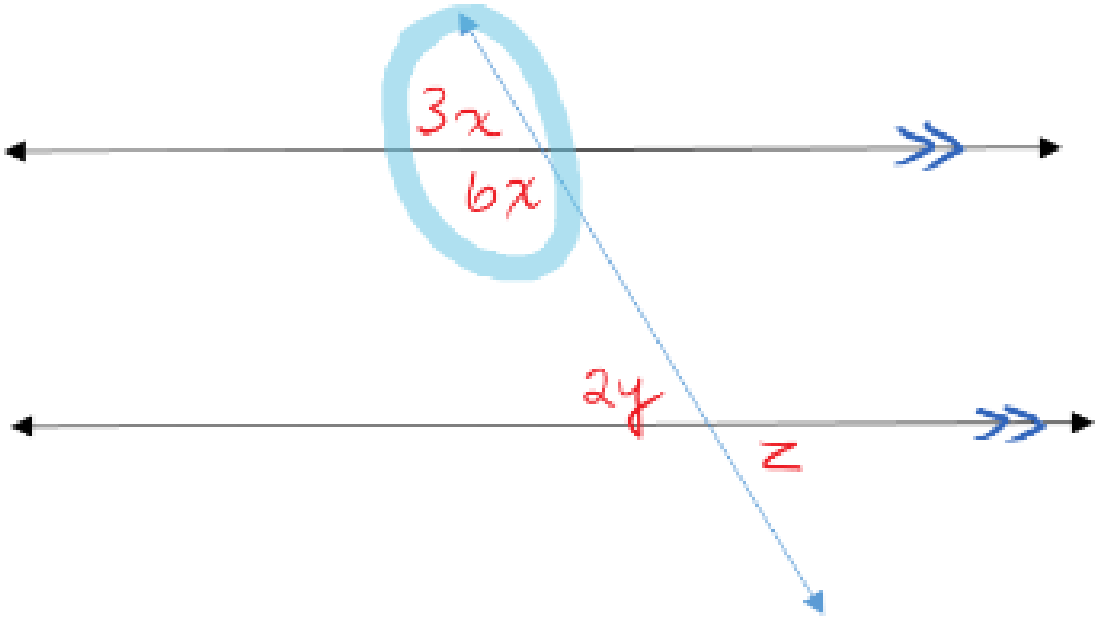
Example #3:

Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



Example #3:

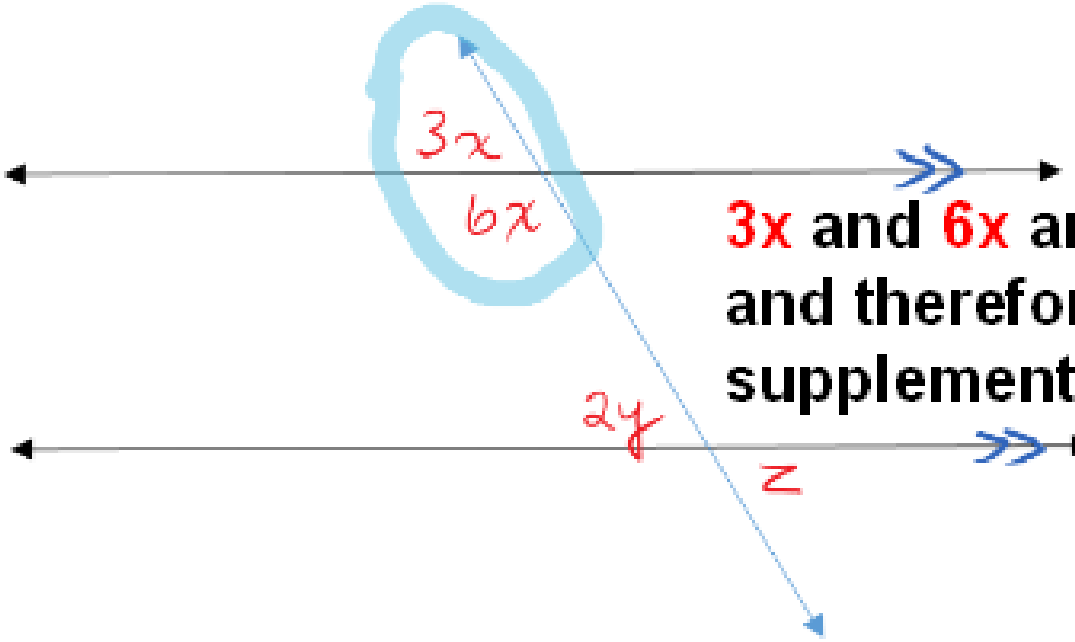
Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



Strategy: To begin, you must find two angles in the diagram that have the same variable and use their relationship to create an equation that you can solve.

Example #3:

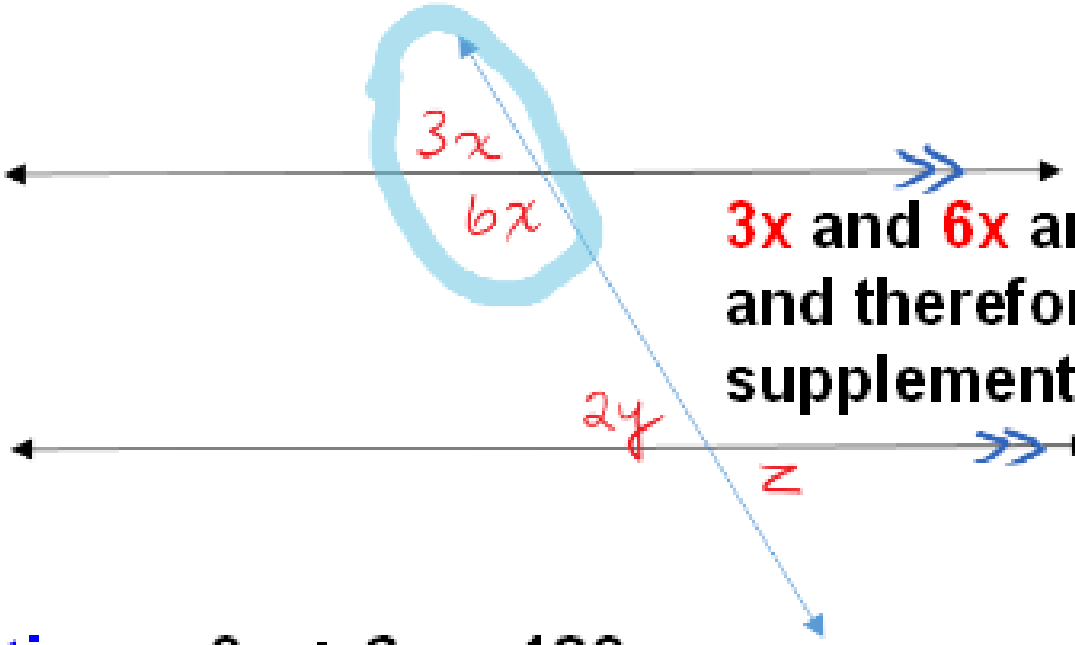
Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



3x and 6x are a linear pair and therefore they are supplementary

Example #3:

Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.

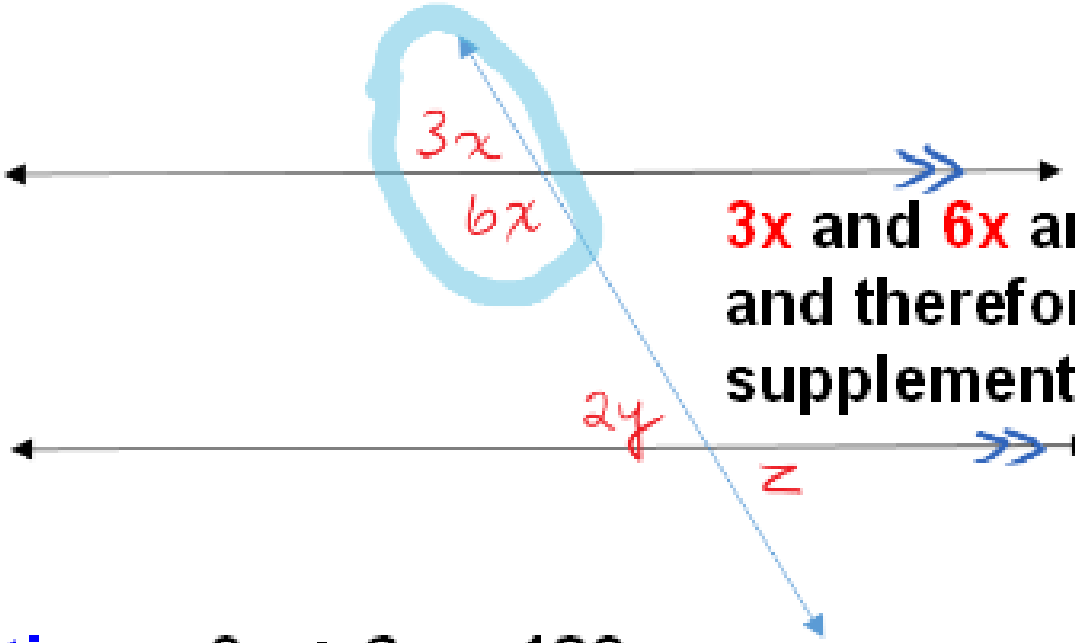


3x and 6x are a linear pair and therefore they are supplementary

Equation: 3x + 6x = 180

Example #3:

Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



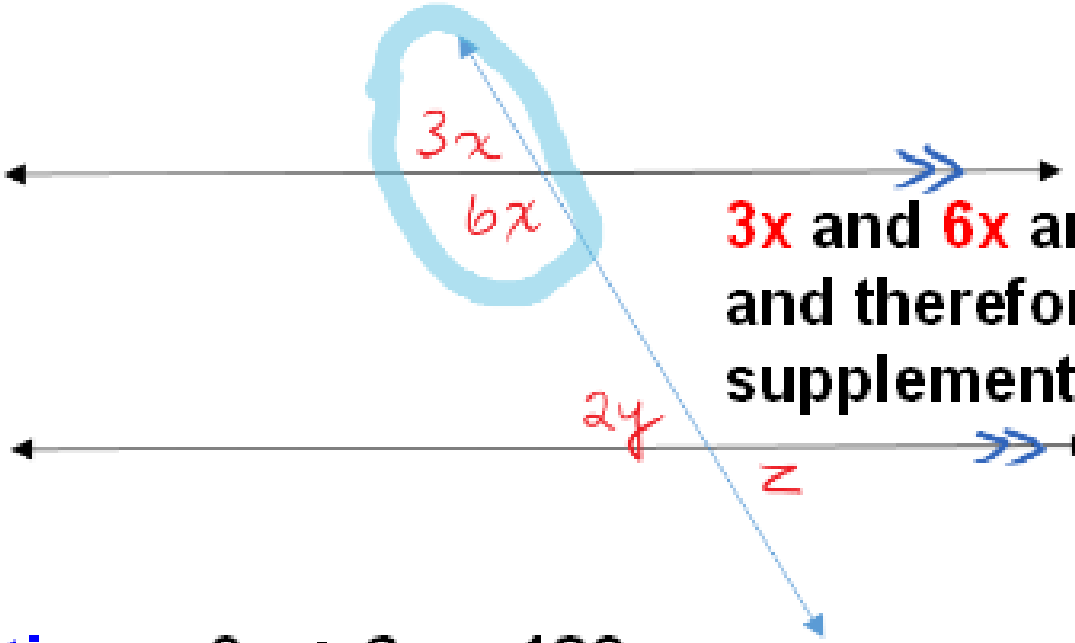
3x and 6x are a linear pair and therefore they are supplementary

Equation: $3x + 6x = 180$

$9x = 180$

Example #3:

Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



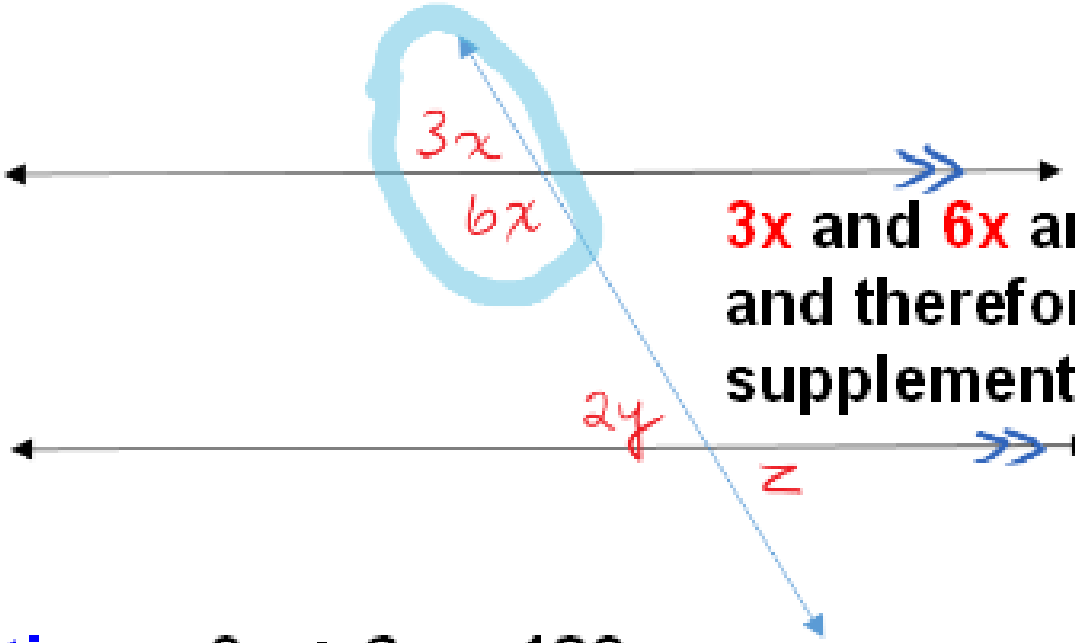
3x and 6x are a linear pair and therefore they are supplementary

Equation: $3x + 6x = 180$

$$\frac{9x}{9} = \frac{180}{9}$$

Example #3:

Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



3x and 6x are a linear pair and therefore they are supplementary

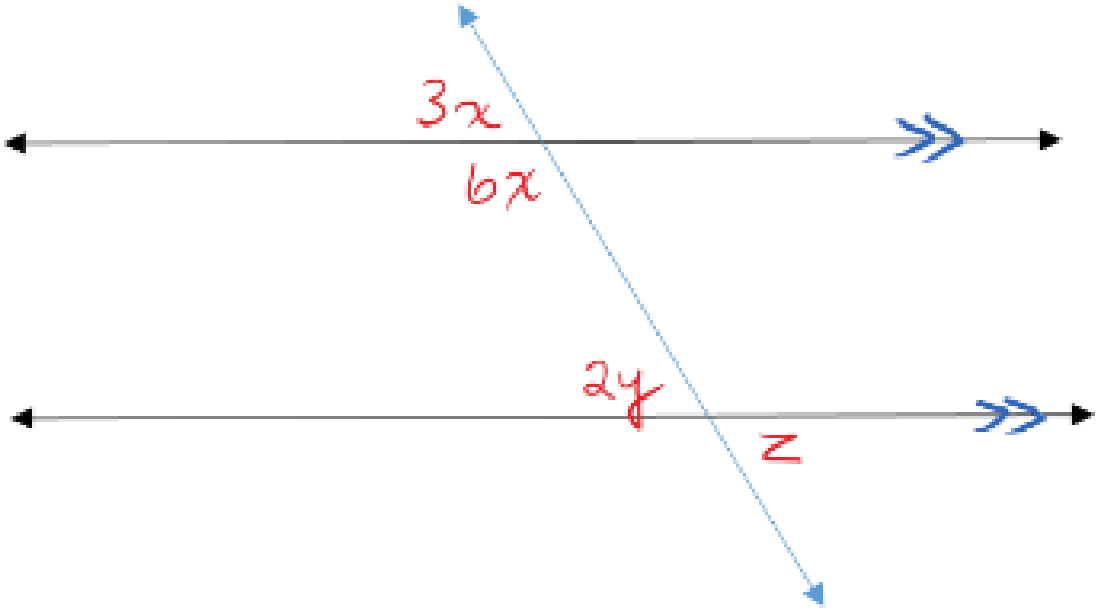
Equation: $3x + 6x = 180$

$$\frac{9x}{9} = \frac{180}{9}$$

$$x = 20$$

Example #3:

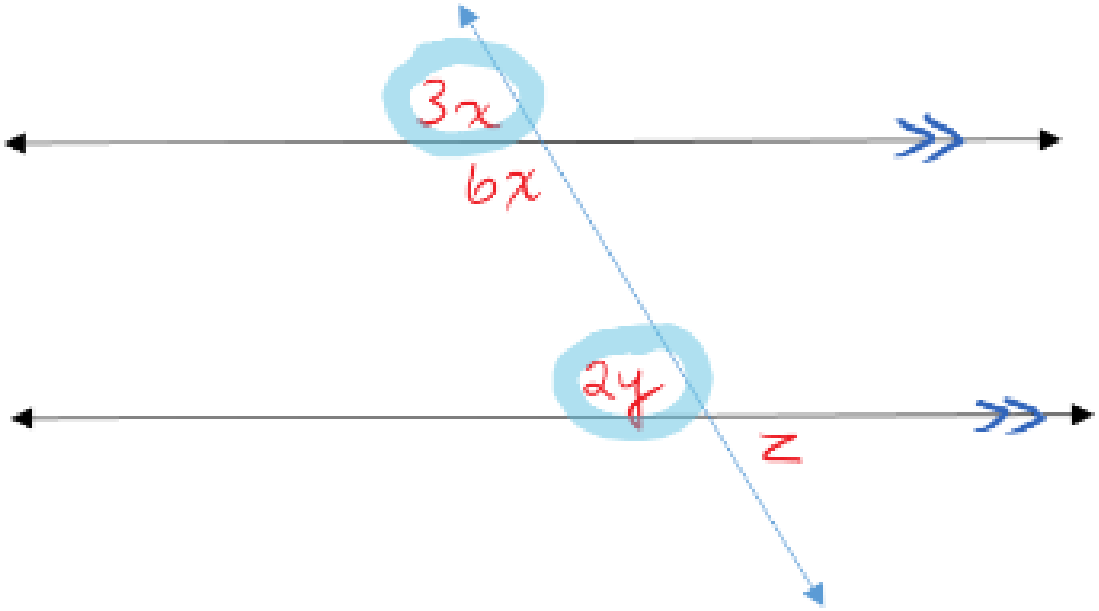
Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



x = 20

Example #3:

Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



x = 20

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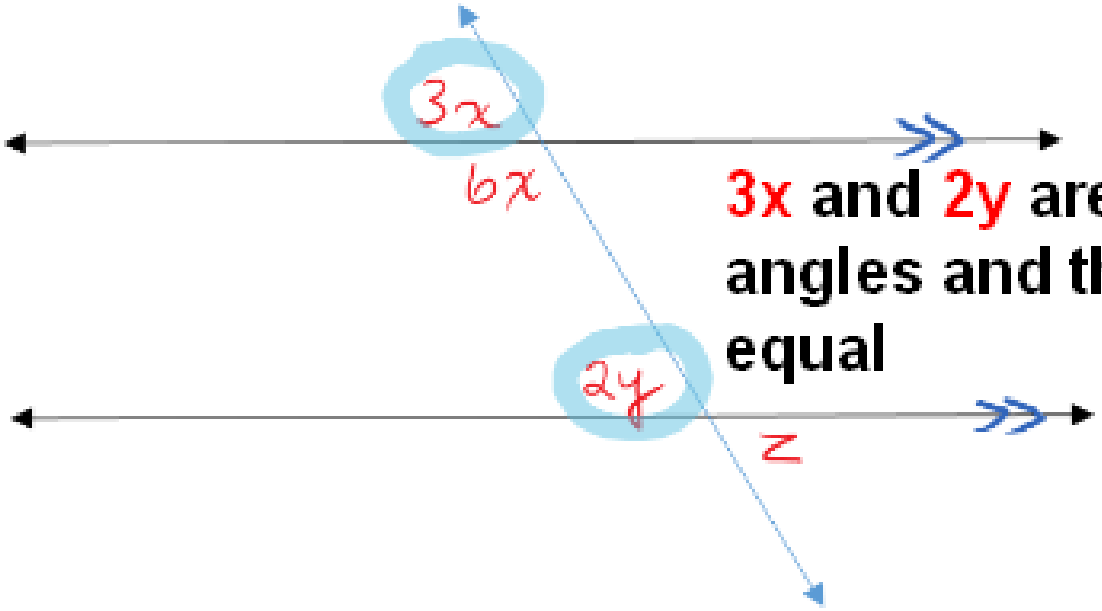
Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.

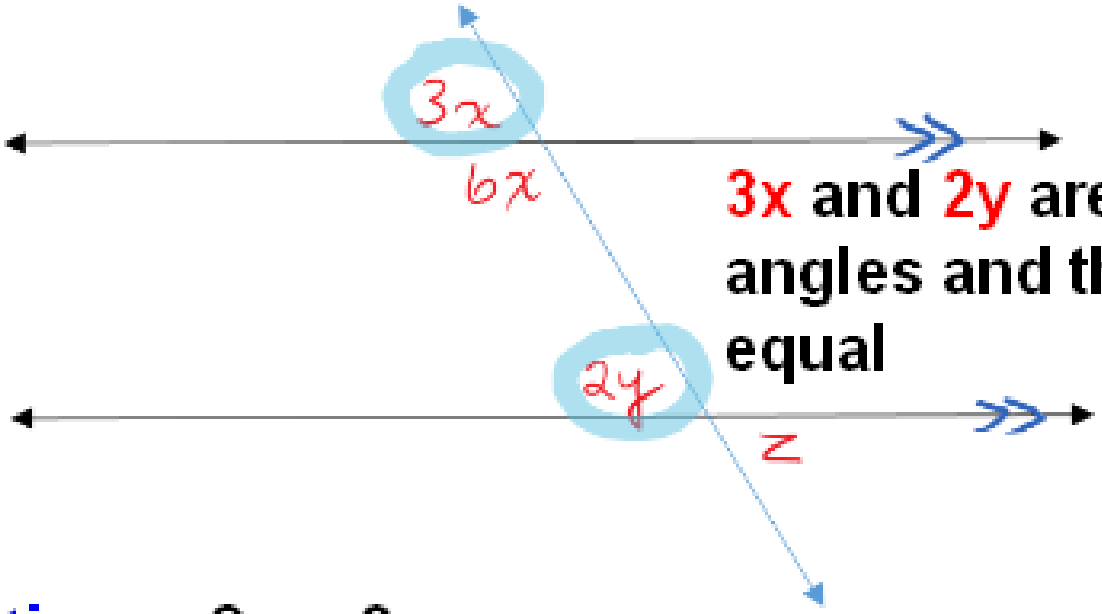


3x and 2y are corresponding angles and therefore they are equal

x = 20

Example #3:

Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



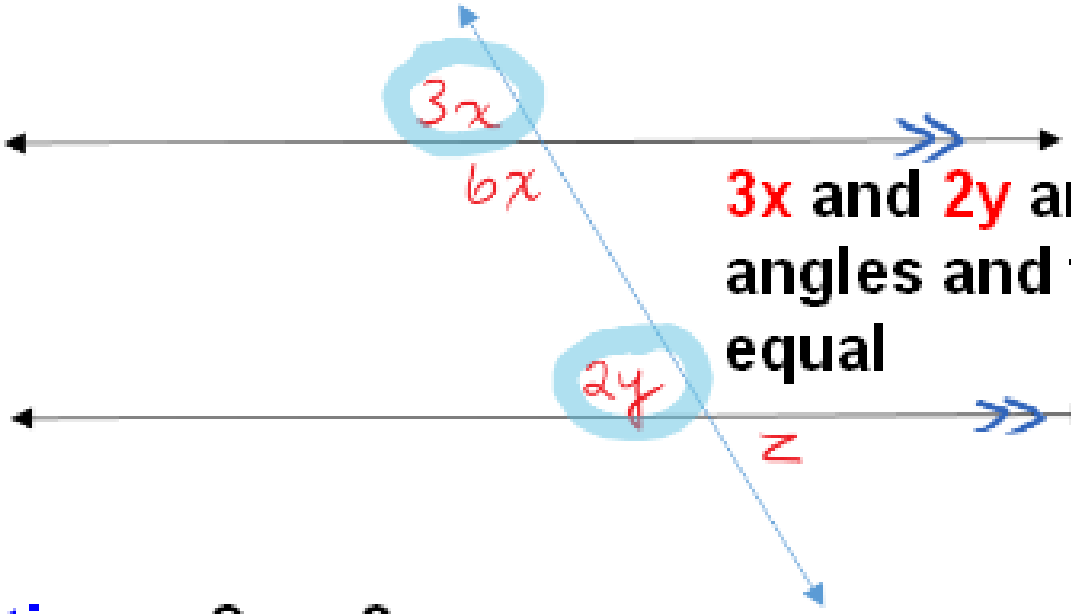
3x and 2y are corresponding angles and therefore they are equal

x = 20

Equation: 2y = 3x

Example #3:

Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



3x and 2y are corresponding angles and therefore they are equal

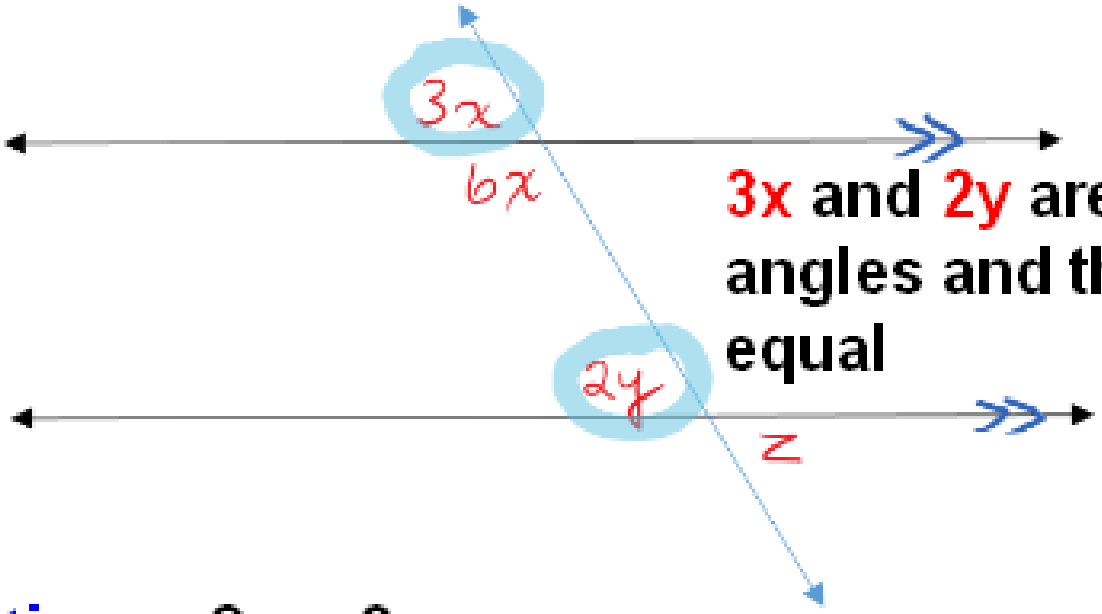
x = 20

Equation: $2y = 3x$

$2y = 3(20)$ because $x = 20$

Example #3:

Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



3x and 2y are corresponding angles and therefore they are equal

x = 20

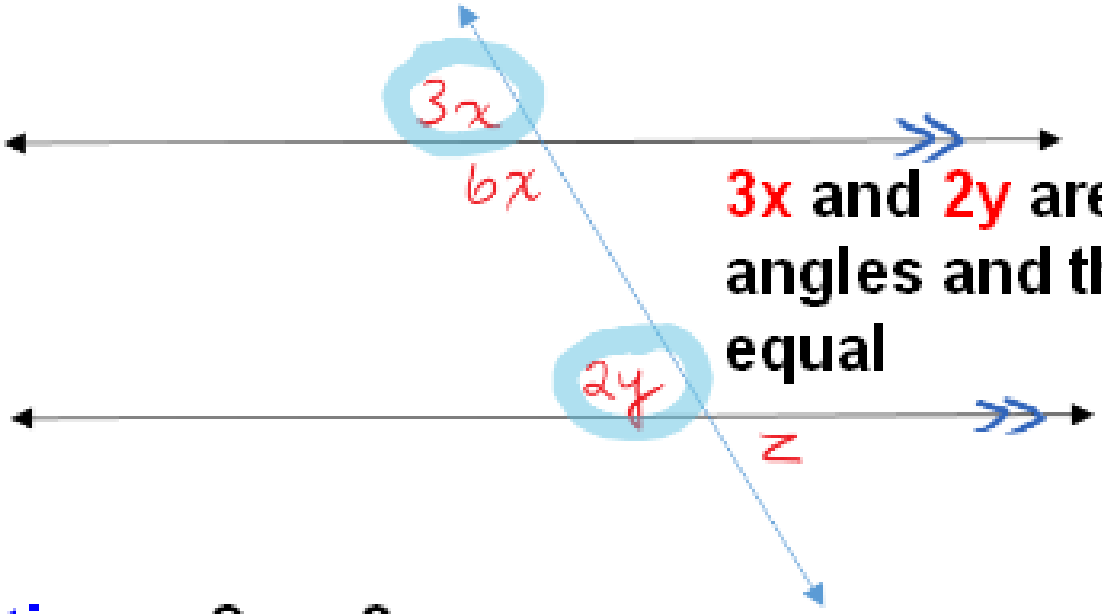
Equation: 2y = 3x

2y = 3(20) because x = 20

2y = 60

Example #3:

Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



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$\frac{2y}{2} = \frac{60}{2}$

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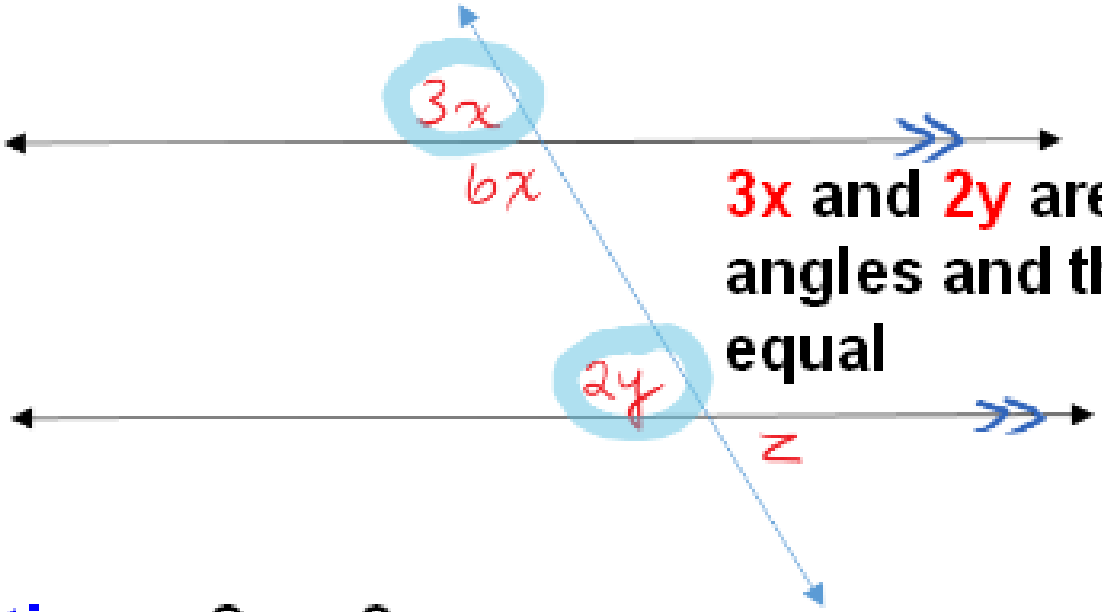
Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



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Equation: $2y = 3x$

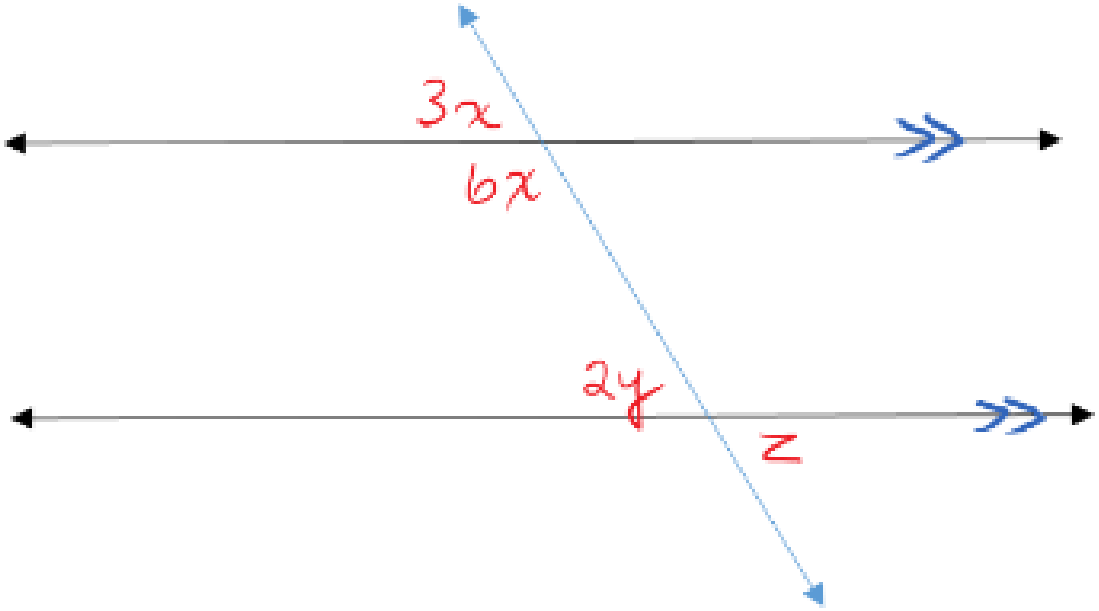
$2y = 3(20)$ because x = 20

$\frac{2y}{2} = \frac{60}{2}$

$y = 30$

Example #3:

Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



x = 20
y = 30

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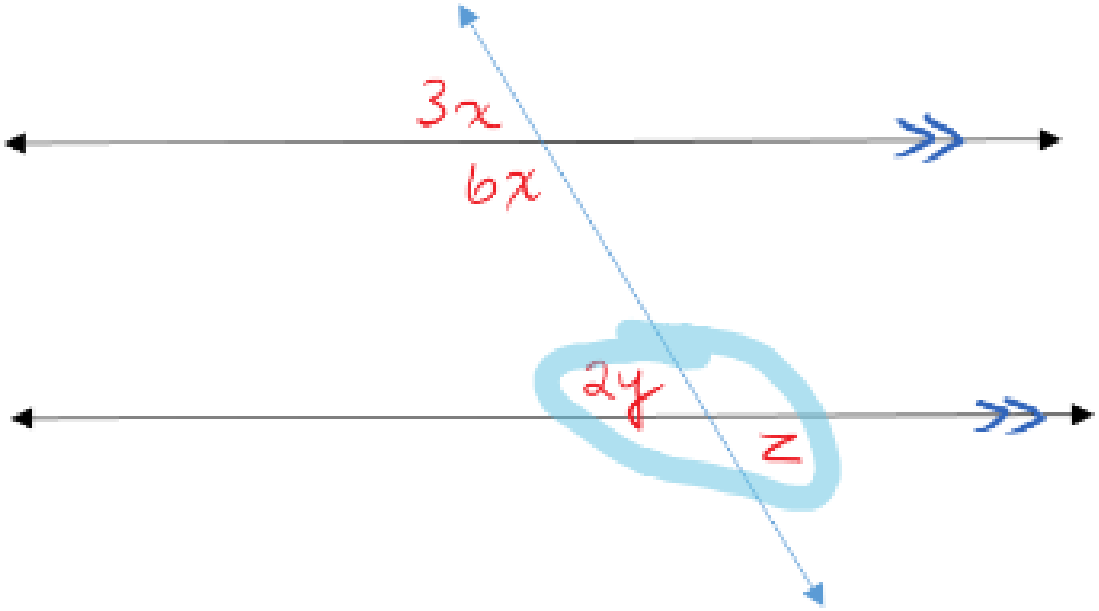
Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



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y = 30

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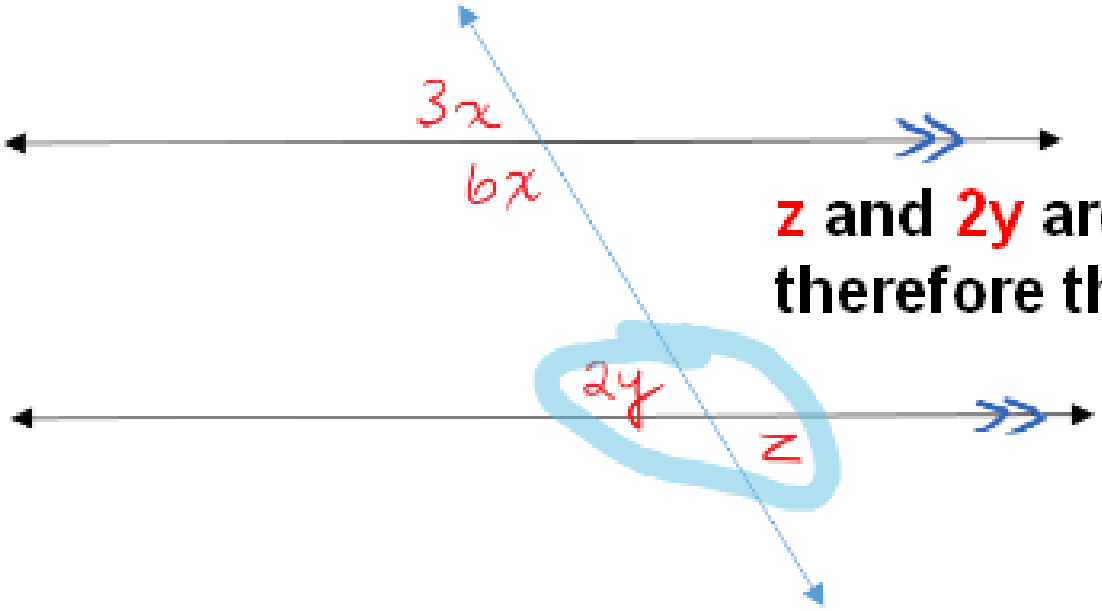
Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



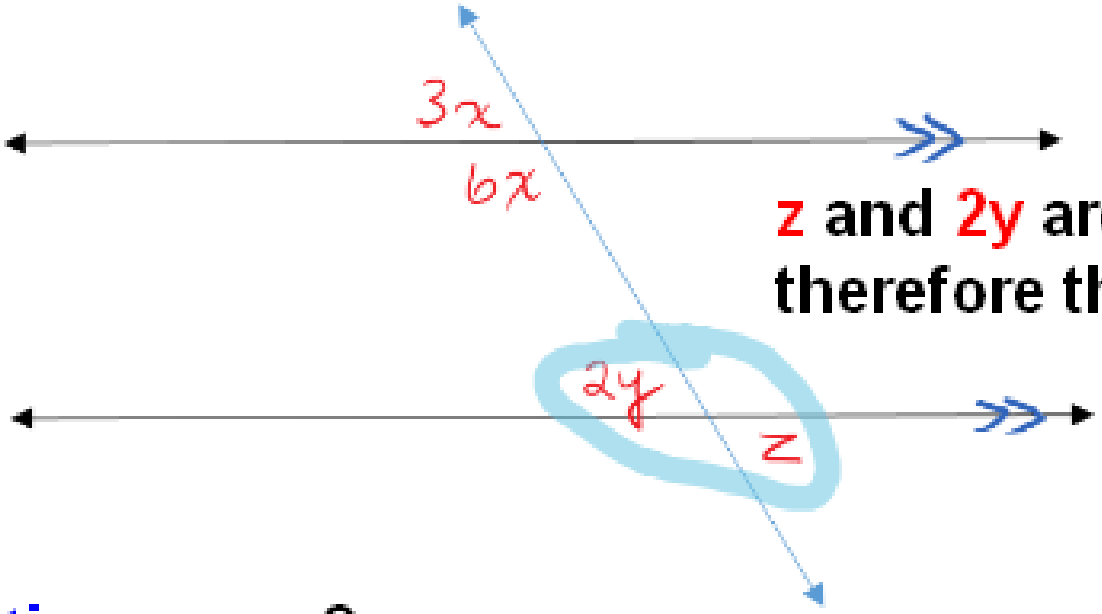
z and 2y are VOA and therefore they are equal

x = 20

y = 30

Example #3:

Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



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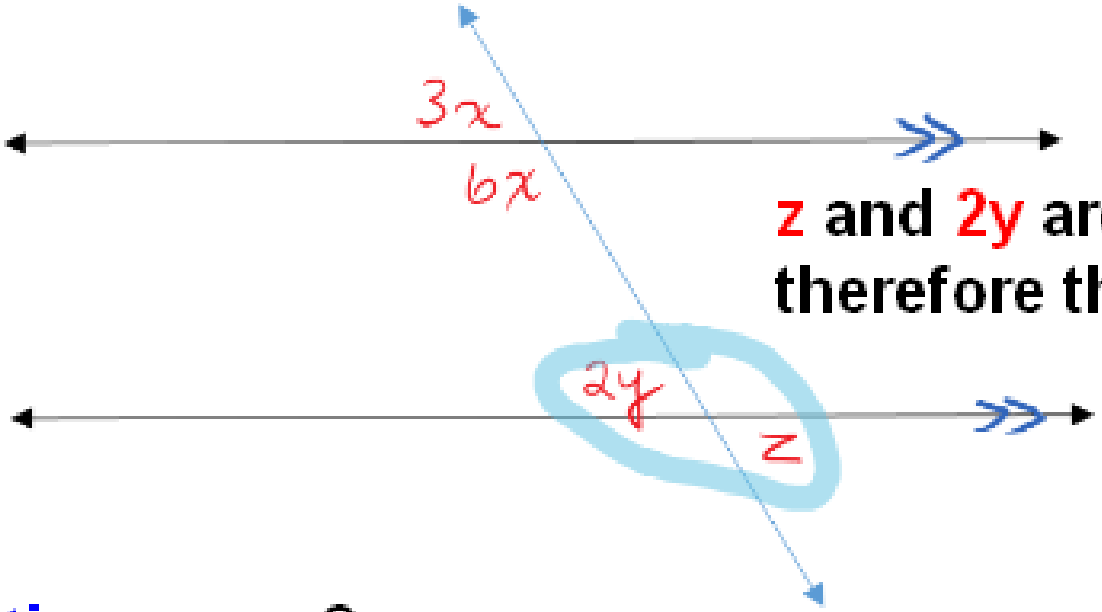


z and 2y are VOA and therefore they are equal

x = 20

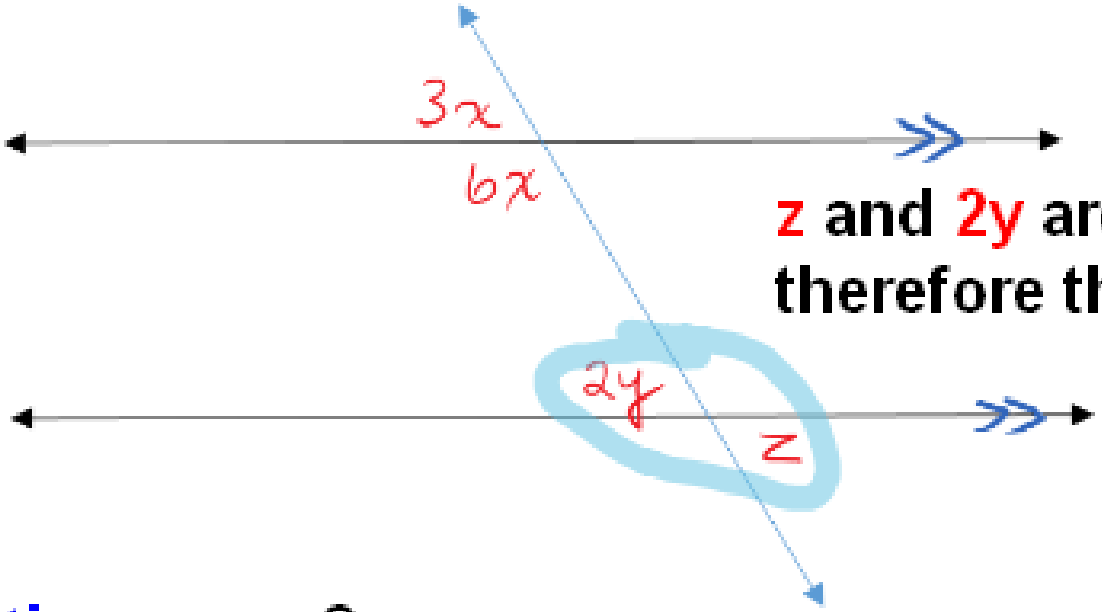
y = 30

Equation: z = 2y

z = 2(30) because y = 30

Example #3:

Determine the values of **x**, **y**, and **z**. Show calculations and give justifications.



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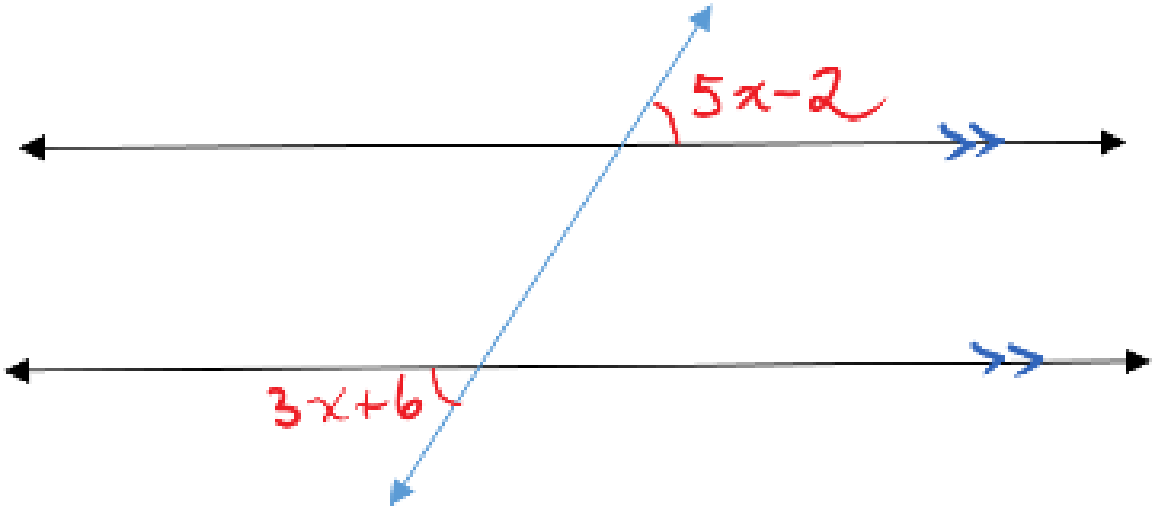
Example #4:

Solve for x. Give justifications and show calculations.



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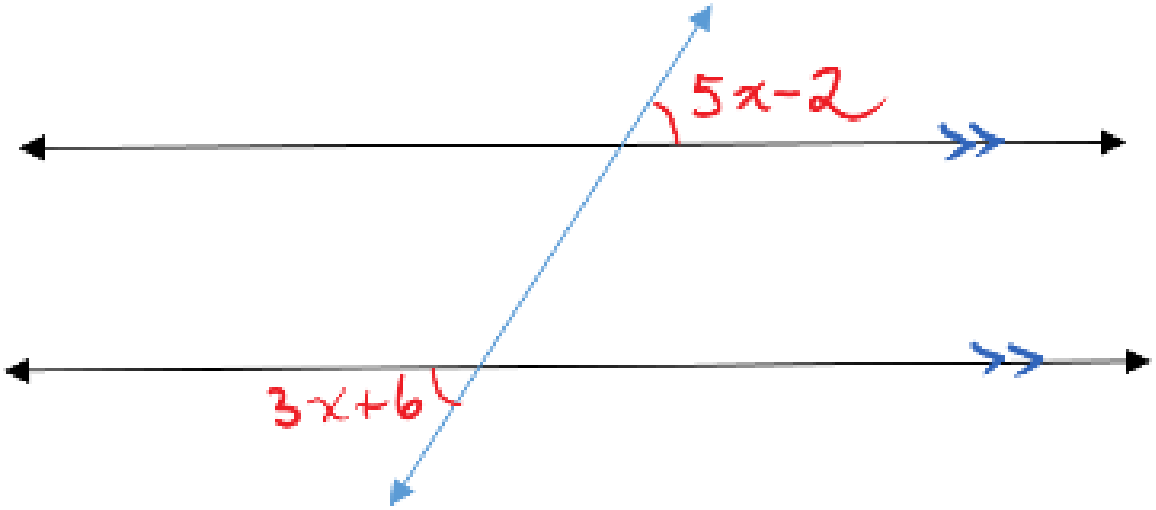
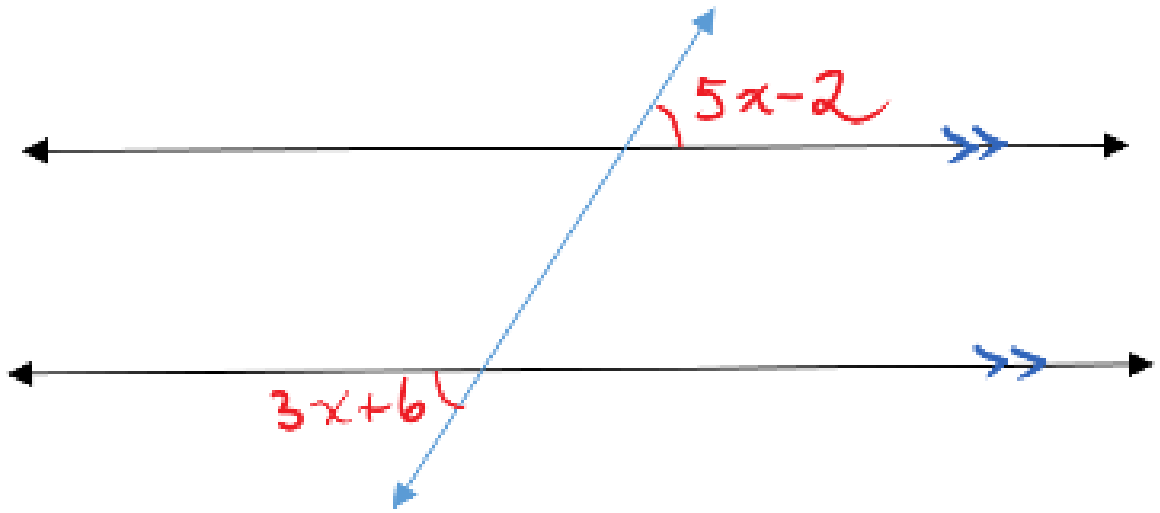
Solve for x. Give justifications and show calculations.



What special angle pair are these two angles?

Example #4:

Solve for x. Give justifications and show calculations.



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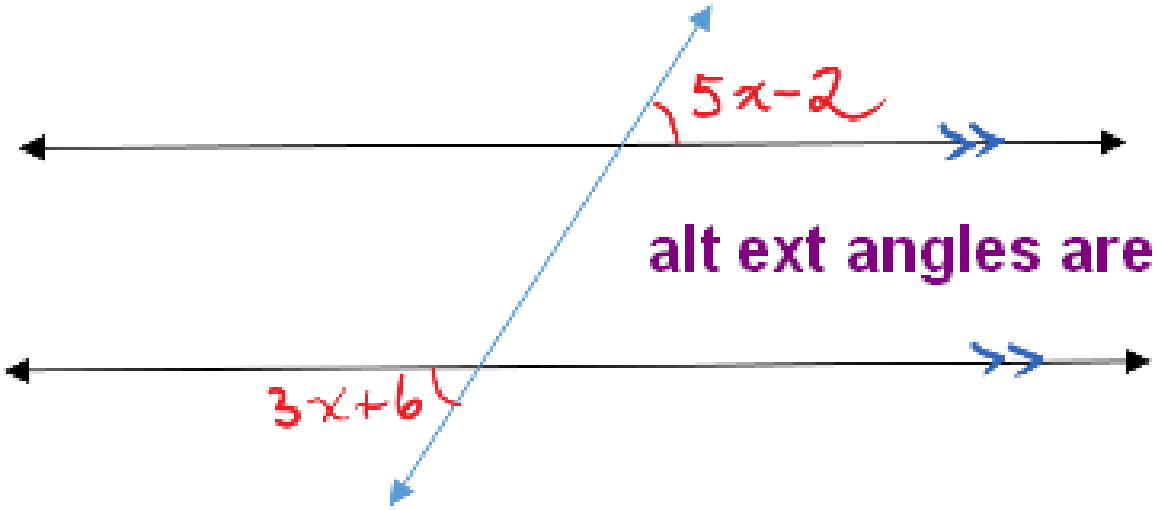
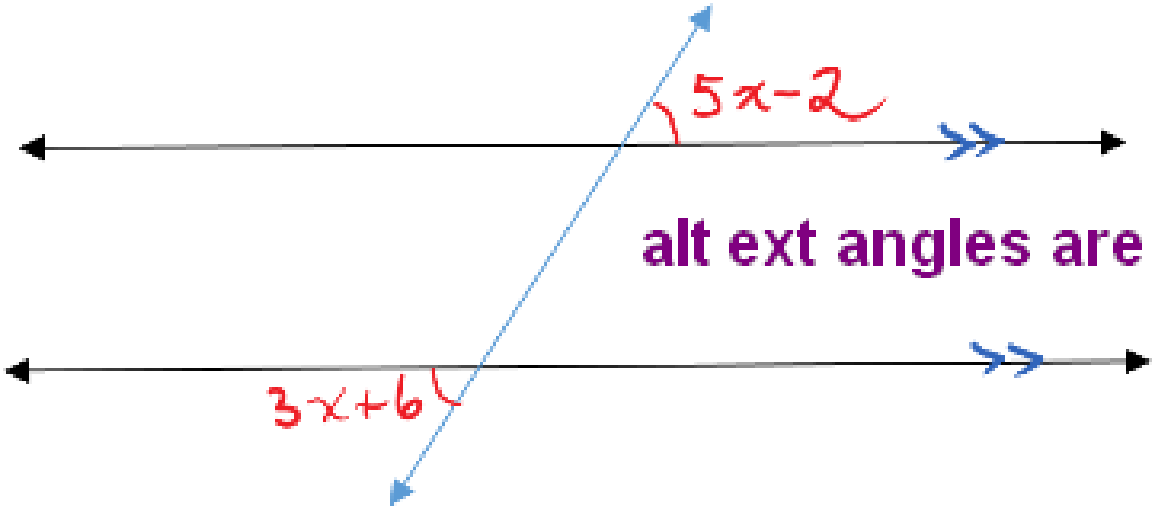


alt ext angles are equal

Equation: $5x - 2 = 3x + 6$

Example #4:

Solve for x. Give justifications and show calculations.



alt ext angles are equal

Equation: $5x - 2 = 3x + 6$

$5x - 3x = 6 + 2$

Example #4:

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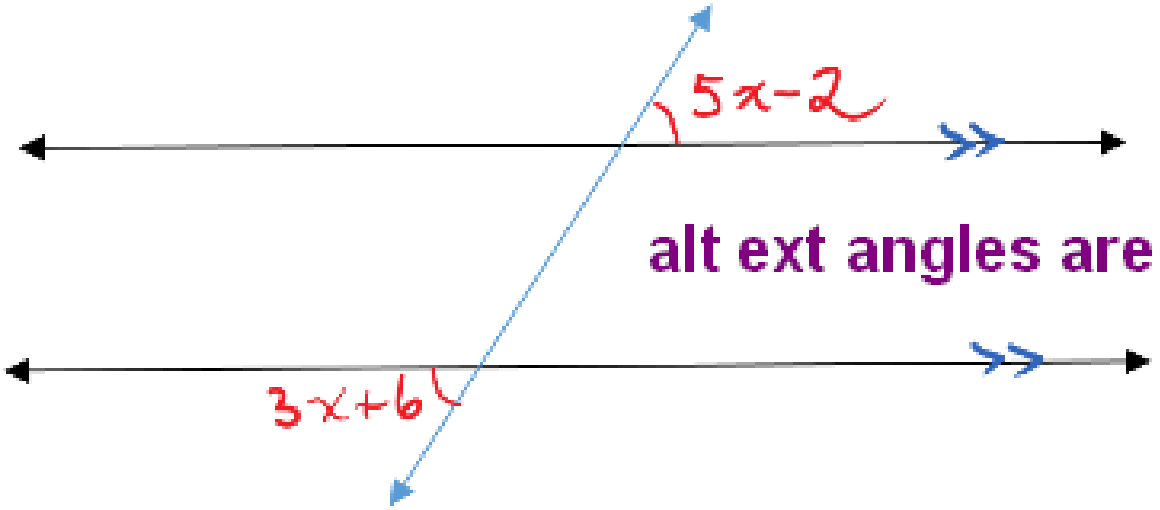


alt ext angles are equal

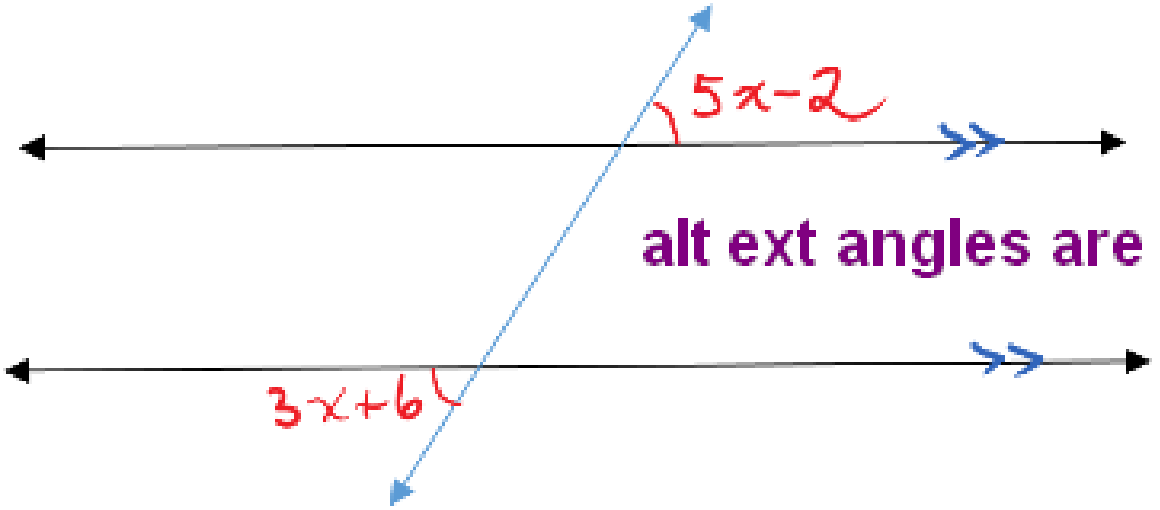
Equation: $5x - 2 = 3x + 6$

$5x - 3x = 6 + 2$

$2x = 8$

Example #4:

Solve for x. Give justifications and show calculations.



alt ext angles are equal

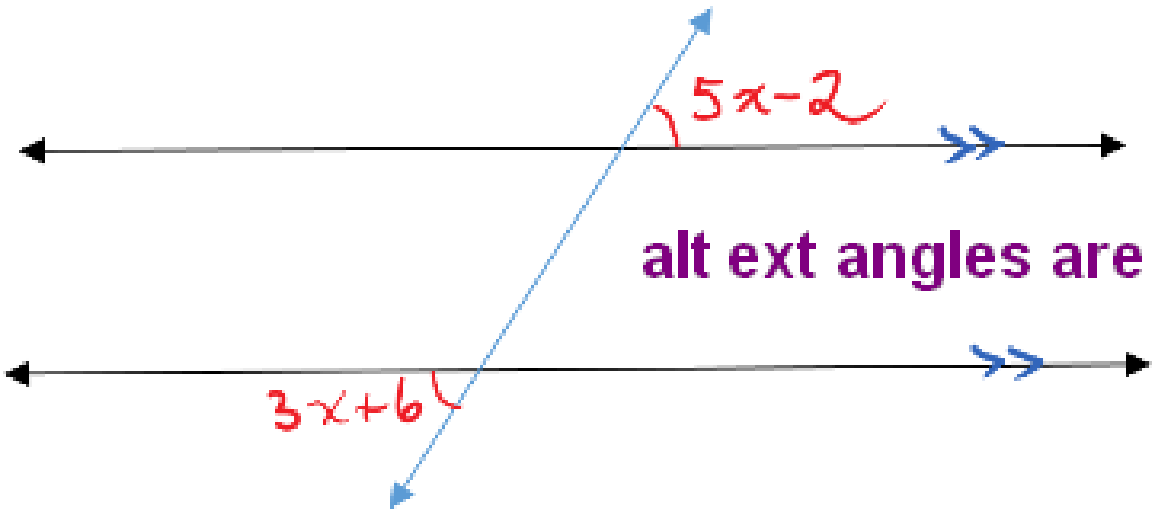
Equation: $5x - 2 = 3x + 6$

$5x - 3x = 6 + 2$

$\frac{2x}{2} = \frac{8}{2}$

Example #4:

Solve for x. Give justifications and show calculations.



alt ext angles are equal

Equation: $5x - 2 = 3x + 6$

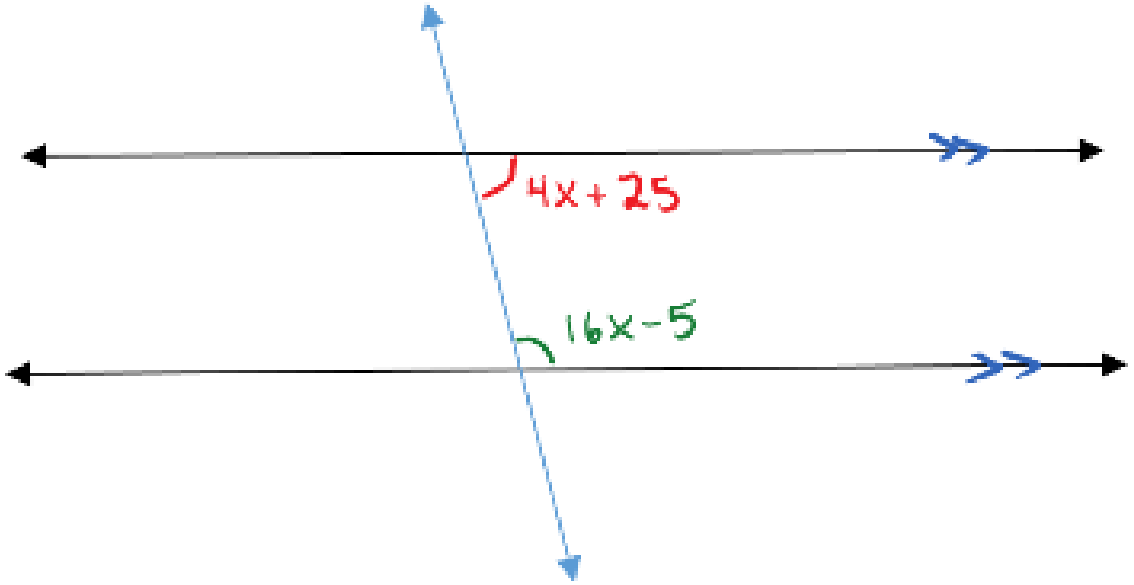
$5x - 3x = 6 + 2$

$\frac{2x}{2} = \frac{8}{2}$

$x = 4$

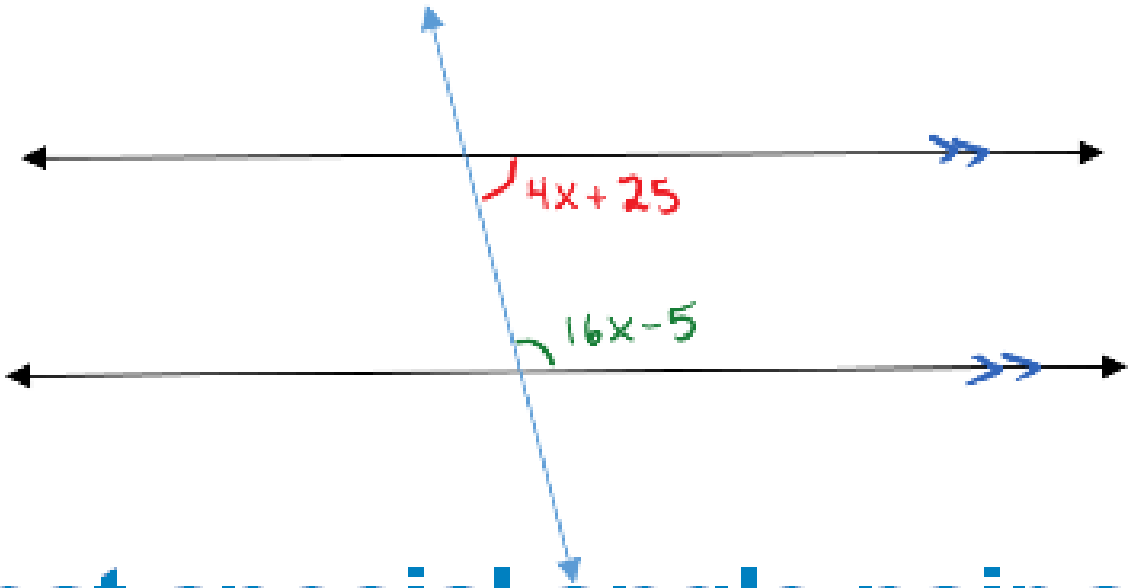
Example #5:

Solve for x. Give justifications and show calculations.



Example #5:

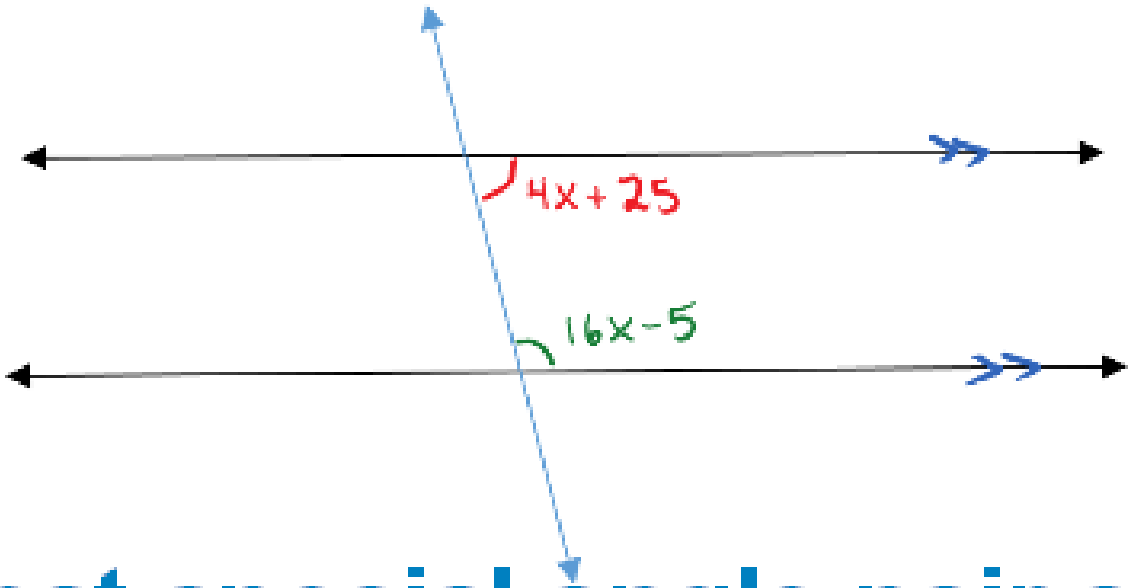
Solve for x. Give justifications and show calculations.



What special angle pair are these two angles?

Example #5:

Solve for x. Give justifications and show calculations.



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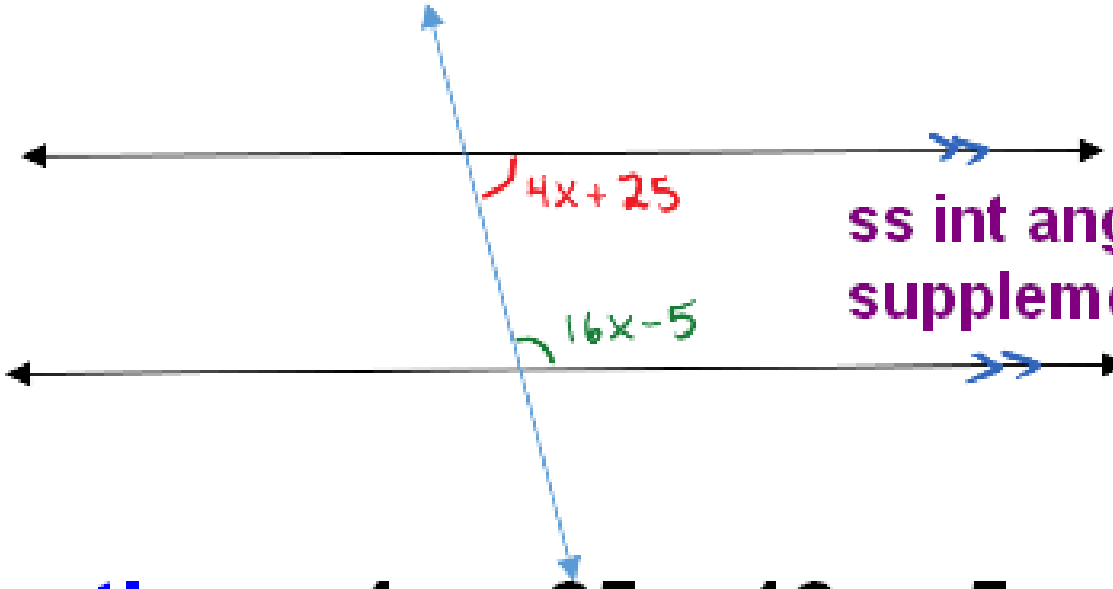
Solve for x. Give justifications and show calculations.

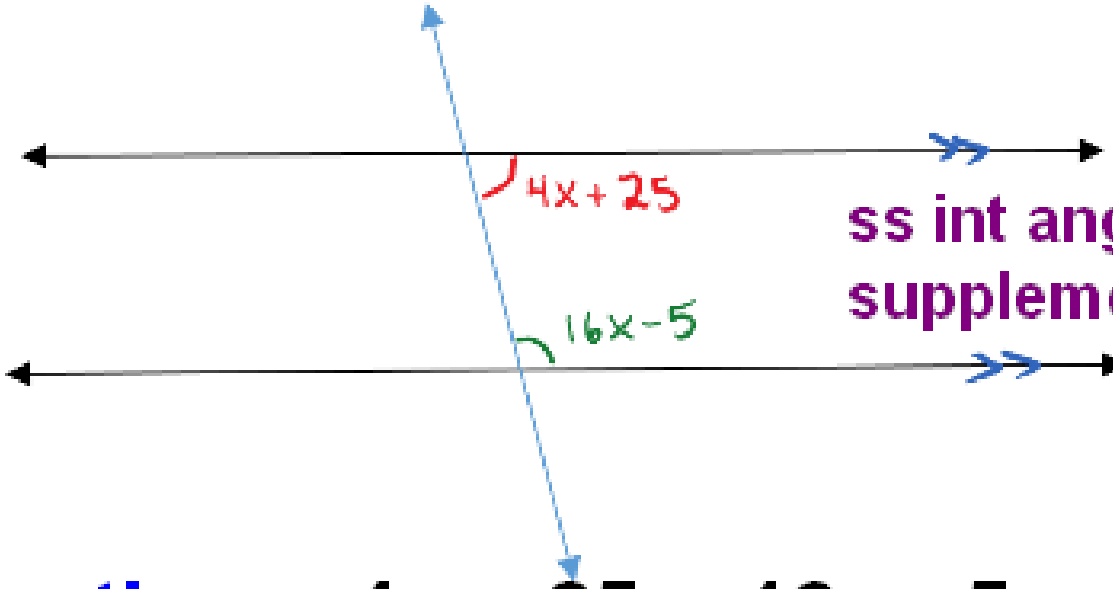


ss int angles are supplementary

Equation: $4x + 25 + 16x - 5 = 180$

Example #5:

Solve for x. Give justifications and show calculations.



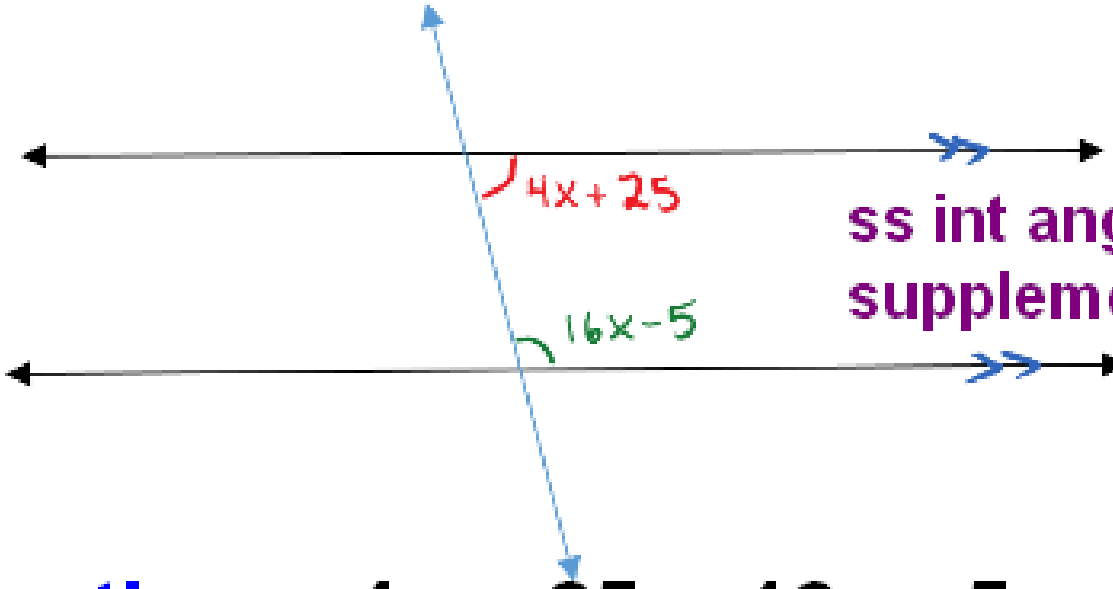
ss int angles are supplementary

Equation: $4x + 25 + 16x - 5 = 180$

$20x + 20 = 180$

Example #5:

Solve for x. Give justifications and show calculations.



ss int angles are supplementary

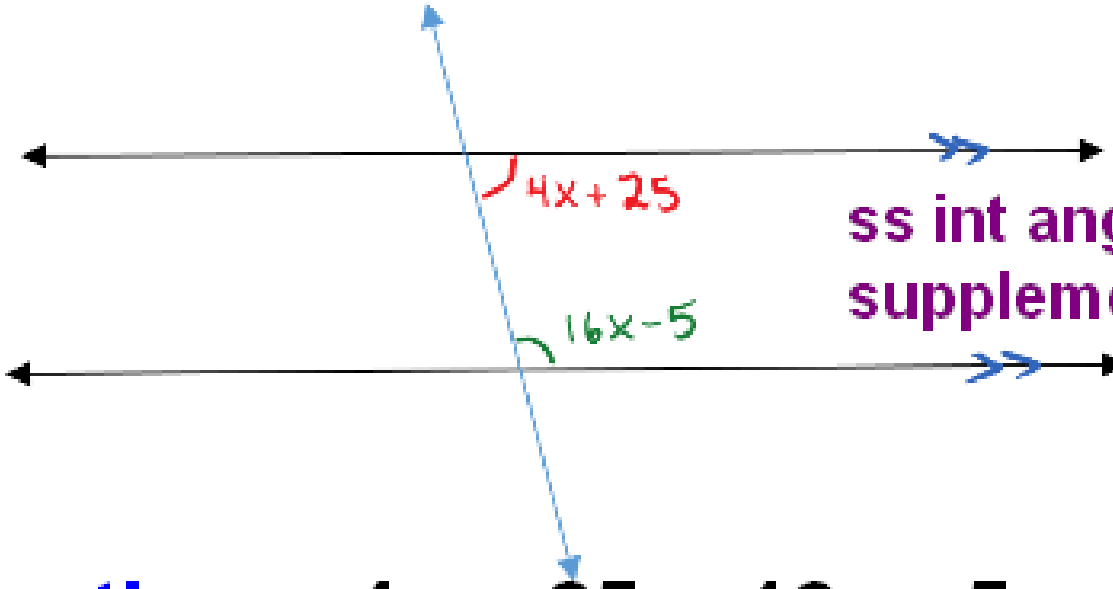
Equation: $4x + 25 + 16x - 5 = 180$

$20x + 20 = 180$

$20x = 160$

Example #5:

Solve for x. Give justifications and show calculations.



ss int angles are supplementary

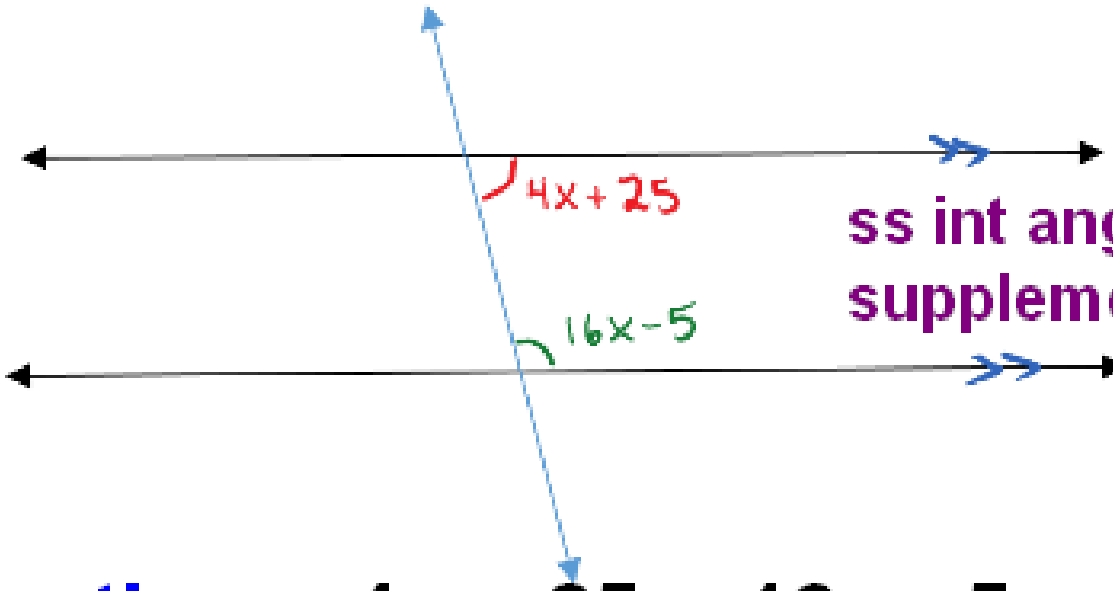
Equation: $4x + 25 + 16x - 5 = 180$

$$20x + 20 = 180$$

$$\frac{20x}{20} = \frac{160}{20}$$

Example #5:

Solve for x. Give justifications and show calculations.



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Equation: $4x + 25 + 16x - 5 = 180$

$$20x + 20 = 180$$

$$\frac{20x}{20} = \frac{160}{20}$$

$$x = 8$$

Check your understanding:

Textbook pg. 78-82
#1, 2, 3, 4, 15, 20

Angle Pair Relationships Worksheet
#19 - 22