Today...

*Correct HW (get ready to ask questions!!)
*Appreciation of Venn Diagrams
*Notes/Practice with conditional statements
1. If $10 + x$ is 5 more than 10, what is the value of $2x$?

(A) –5
(B) 5
(C) 10
(D) 25
(E) 50
2. The result when a number is divided by 2 is equal to the result when that same number is divided by 4. What is that number?

(A) –4  
(B) –2  
(C) 0  
(D) 2  
(E) 4
7. If \( n \) and \( k \) are positive integers and \( 8^n = 2^k \), what is the value of \( \frac{n}{k} \)?

(A) \( \frac{1}{4} \)

(B) \( \frac{1}{3} \)

(C) \( \frac{1}{2} \)

(D) 3

(E) 4
12. If a positive integer \( n \) is picked at random from the positive integers less than or equal to 10, what is the probability that \( 5n + 3 \leq 14 \)?

(A) 0

(B) \( \frac{1}{10} \)

(C) \( \frac{1}{5} \)

(D) \( \frac{3}{10} \)

(E) \( \frac{2}{5} \)
4, 11, 18, ... 

1. In the sequence above, the first term is 4 and each term after the first is 7 more than the previous term. What is the 12th term of the sequence?

(A) 77
(B) 81
(C) 84
(D) 86
(E) 92
All of Kay’s brothers can swim.

4. If the statement above is true, which of the following must also be true?
   
   (A) If Fred cannot swim, then he is not Kay’s brother.  
   (B) If Dave can swim, then he is not Kay’s brother.  
   (C) If Walt can swim, then he is Kay’s brother.  
   (D) If Pete is Kay’s brother, then he cannot swim.  
   (E) If Mark is not Kay’s brother, then he cannot swim.
2-1 Skills Practice

Inductive Reasoning and Conjecture

Make a conjecture about the next item in each sequence.

1. 

2. $-4, -1, 2, 5, 8$ 

3. $6, \frac{11}{2}, 5, \frac{9}{2}, 4$ 

4. $-2, 4, -8, 16, -32$ 

NAME ___________________________ DATE __________ PERIOD ______
Make a conjecture based on the given information. Draw a figure to illustrate your conjecture.

5. Points $A$, $B$, and $C$ are collinear, and $D$ is between $B$ and $C$.

6. Point $P$ is the midpoint of $\overline{NQ}$.

7. $\angle 1$, $\angle 2$, $\angle 3$, and $\angle 4$ form four linear pairs.

8. $\angle 3 \equiv \angle 4$
Determine whether each conjecture is true or false. Give a counterexample for any false conjecture.

9. Given: \( \angle ABC \) and \( \angle CBD \) form a linear pair.
   Conjecture: \( \angle ABC \cong \angle CBD \)

10. Given: \( \overline{AB}, \overline{BC}, \) and \( \overline{AC} \) are congruent.
    Conjecture: \( A, B, \) and \( C \) are collinear.

11. Given: \( AB + BC = AC \)
    Conjecture: \( AB = BC \)

12. Given: \( \angle 1 \) is complementary to \( \angle 2 \), and \( \angle 1 \) is complementary to \( \angle 3 \).
    Conjecture: \( \angle 2 = \angle 3 \)

\[ \begin{align*}
\text{If } & m\angle 1 = x, \text{ then } \\
& m\angle 2 = 90 - x \\
& m\angle 3 = 90 - x \\
\text{So } & \angle 2 \cong \angle 3
\end{align*} \]
Exercises

1. The coldest day of the year in Chicago occurred in January for five straight years. Is it safe to conclude that the coldest day in Chicago is always in January? \( \text{No} \)
2. Suppose John misses the school bus four Tuesdays in a row. Can you safely conclude that John misses the school bus every Tuesday?

[No]
3. Is the equation $\sqrt{k^2} = k$ true when you replace $k$ with 1, 2, and 3? Is the equation true for all integers? If possible, find a counterexample.

$k = 1: \sqrt{1^2} = 1 \checkmark$
$k = 2: \sqrt{2^2} = 2 \checkmark$
$k = 3: \sqrt{3^2} = 3 \checkmark$

4. $\ldots -2, -1, 0, 1, 2, \ldots$
4. Is the statement $2x = x + x$ true when you replace $x$ with $\frac{1}{2}$, 4, and 0.7? Is the statement true for all real numbers? If possible, find a counterexample.

Yes:
- $x = \frac{1}{2}$: $2(\frac{1}{2}) = \frac{1}{2} + \frac{1}{2}$ ✓ (both sides = 1)
- $x = 4$: $2(4) = 4 + 4$ ✓ (both sides = 8)
- $x = 0.7$: $2(0.7) = 0.7 + 0.7$ ✓ (both sides = 1.4)
5. Suppose you draw four points \(A, B, C,\) and \(D\) and then draw \(AB, BC, CD,\) and \(DA.\) Does this procedure give a quadrilateral always or only sometimes? Explain your answers with figures.

6. Suppose you draw four points \(A, B, C,\) and \(D\) and then draw \(AB, BC, CD,\) and \(DA.\) Does this procedure give a quadrilateral always or only sometimes? Explain your answers with figures.
6. Suppose you draw a circle, mark three points on it, and connect them. Will the angles of the triangle be acute? Explain your answers with figures.
2.2 Venn Diagrams

John Venn
Aug 4, 1834 - Apr 4, 1932

Everything that is A is also B.
EX  Jo is a student at SHS. \{A\}
Jo is a sophomore. \{B\}

- All sophomores are at SHS.
- No sophomores anywhere else.
MUSIC For Exercises 25–28, use the following information.
A group of 400 teens were asked what type of music they listened to. They could choose among pop, rap, and country. The results are shown in the Venn diagram.

25. How many said that they listened to none of these types of music?
26. How many said that they listened to all three types of music?
27. How many said that they listened to only pop and rap music?
28. How many said that they listened to pop, rap, or country music?
SCHOOL For Exercises 29–31, use the following information.
In a school of 310 students, 80 participate in academic clubs, 115 participate in sports, and 20 students participate in both.
29. Make a Venn diagram of the data.
30. How many students participate in either academic clubs or sports?
31. How many students do not participate in either academic clubs or sports?
GEOGRAPHY For Exercises 42–44, use the following information. A travel agency surveyed its clients about places they had visited. Of the participants, 60 had visited Europe, 45 visited England, and 50 visited France.

42. Make a Venn diagram of the data.
43. Write a conjunction from the data.
44. Write a disjunction from the data.
2.3 Conditional Statements

... a statement that can be written in if-then form.

IF \textit{(hypothesis)}, \textit{then} \textit{(conclusion)}.

\textit{Ex.} \ IF IT RAINS ON SUNDAY, \ THEN WE WON'T HAVE A PICNIC.
Write the following as conditional statements:

Ex. Everyone who came to class on Monday gets a bonus point.

IF YOU CAME TO CLASS ON MONDAY, THEN YOU GET A BONUS POINT,

Ex. Another performance will be scheduled if the first one is sold out.
Determine the hypothesis and conclusion of each conditional statement.

1. If it is Saturday, then there is no school.

2. Pass in your test if you are finished.

3. All apes love bananas.

4. No one in this class likes backgammon.
Conclusion

Hypothesis
We can change the hypothesis and conclusion to form related conditional statements.

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* 

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Ex.

Given that the original conditional statement is true, write the related conditional statements.

Original: If you are an ape, then you like bananas.

Converse: If you like bananas, then you are an ape.

Original: If you are an ape, then you like bananas.

Inverse: If you are not an ape, then you do not like bananas.

Original: If you are an ape, then you like bananas.

Contrapositive: If you do not like bananas, then you are not an ape.
Practice: Write the converse, inverse, and contrapositive of each conditional statement. Then determine (using your own knowledge of the world) whether each is true or false.

1. If you live in Salem, NH, then you live in the USA.
   - converse:
   - inverse:
   - contrapositive:

2. An acute angle is an angle whose measure is less than 90°
   - converse:
   - inverse:
   - contrapositive:

3. All rectangles are quadrilaterals.
   - converse:
   - inverse:
   - contrapositive:
Practice: Write the **converse**, **inverse**, and **contrapositive** of each conditional statement. Then determine (using your own knowledge of the world) whether each is **true** or **false**.

1. If you live in Salem, NH, then you live in the USA.
   - **converse**: If you live in the USA, then you live in Salem, NH.
   - **inverse**: If you do not live in Salem, NH, then you do not live in the USA.
   - **contrapositive**: If you do not live in the USA, then you do not live in Salem, NH.

2. An acute angle is an angle whose measure is less than 90°
   - **If an angle is acute, then its measure is less than 90°**
   - **converse**: If an angle has a measure less than 90, then it is acute.
   - **inverse**: If an angle is not acute, then its measure is greater than or equal to 90.
   - **contrapositive**: If an angle has a measure greater than or equal to 90, then it is not acute.

3. All rectangles are quadrilaterals.
   - **If a shape is a rectangle, then it is a quadrilateral.**
   - **converse**: If a shape is a quadrilateral, then it is a rectangle.
   - **inverse**: If a shape is not a rectangle, then it is not a quadrilateral.
   - **contrapositive**: If a shape is not a quadrilateral, then it is not a rectangle.