



UNDERSTAND

9. **Error Analysis** Samantha writes the following as an example of using the Law of Syllogism. Explain Samantha's error.

If an animal is a dog, then it is a mammal.
If an animal is a dog, then it has four legs.

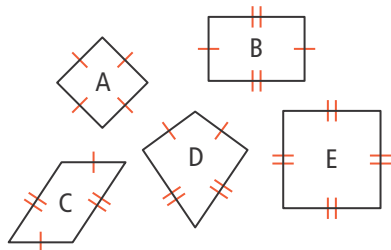
I can conclude that if an animal has four legs, then it is a mammal.



10. **Look for Relationships** Make a truth table with statements p , q , r , $p \rightarrow q$, $q \rightarrow r$, and $p \rightarrow r$. How does the truth table support the validity of the Law of Syllogism and the Law of Detachment?
11. **Mathematical Connections** Consider the following conditional.

If all four sides of a quadrilateral are of equal length, then its diagonals intersect at right angles.

Which of the following figures can you use with the conditional to apply the Law of Detachment to draw the conclusion that its diagonals intersect at right angles?



12. **Higher Order Thinking** Suppose you are given that a conditional is true but its conclusion is false. What can you conclude about the hypothesis? Explain your answer using the negation of the hypothesis and the conclusion with the Law of Detachment.
13. **Look for Relationships** To apply the Law of Detachment, a conditional statement and its hypothesis must both be true. Can you draw any conclusions if the conditional is true but the hypothesis is false? Explain.

PRACTICE

Determine the truth value of the following conditional. SEE EXAMPLE 1

14. If two adjacent angles form a right angle, then the angles are complementary.

Assume that each set of statements is true. Use the Law of Detachment to write a true statement. If the Law of Detachment cannot be used, explain why. SEE EXAMPLE 2

15. If you can play the piano, then you can play a musical instrument. Kiyo can play a musical instrument.
16. If the endpoints of a segment are $P(x_1, y_1)$ and $Q(x_2, y_2)$, then the coordinates of the midpoint are $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$. The endpoints of $\overline{CD}$ are $C(2, -4)$ and $D(-3, 5)$.
17. If the graph of a linear function has a positive slope, then the function is not decreasing. The slope of the graph is 0.

Assume that each set of conditionals is true. Use the Law of Syllogism to write a true conditional. If the Law of Syllogism cannot be used, explain why. SEE EXAMPLE 3

18. If $\overrightarrow{BD}$ bisects $\angle ABC$, then $\angle ABD \cong \angle DBC$.
If $\angle ABD \cong \angle DBC$, then $m\angle ABD = m\angle DBC$.
19. If a whole number is even, then it is divisible by 2. If the sum of the digits of a whole number is divisible by 3, then the whole number is divisible by 3.
20. If Zachary eats pasta for dinner, then he goes to bed early. If it is Tuesday night, then Zachary eats pasta for dinner.

Use the Law of Detachment and the Law of Syllogism to draw conclusions from each set of true statements. SEE EXAMPLE 4

21. If it is Thursday, then Charles has baseball practice. If Charles has baseball practice, then he eats grilled chicken for dinner. It is the day after Wednesday.
22. If the length of a segment is PQ , then the distance from P to the midpoint of $\overline{PQ}$ is $\frac{1}{2}PQ$. If the endpoints of a segment are $P(x_1, y_1)$ and $Q(x_2, y_2)$, then the length of the segment is $PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. The endpoints of $\overline{PQ}$ are $P(3, -4)$ and $Q(-3, -12)$.

APPLY

- 23. Model With Mathematics** Represent each true statement with symbols. Use symbols to write related contrapositives of the conditionals. Then use the Law of Detachment and the Law of Syllogism to draw a conclusion.

If Avery draws a numbered card from 4 to 10, then his game piece moves to home base. If his game piece moves to home base, he wins the game. Avery does not win.

- 24. Mathematical Connections** The chart describes the number of tickets needed to win prizes at a family fun center.

Numbers of Tickets	Prize Level	Sample Prizes
0–100	A	magnet, stickers
101–200	B	keychain, flashlight
201–300	C	earbuds, MP3 speaker

- Write conditionals with sample prizes as the hypothesis and prize level as the conclusion. Write conditionals that relate the prize level to the number of tickets.
 - Ines wins an MP3 speaker. Use the Law of Detachment and Law of Syllogism to write true statements about Ines based on the conditionals you wrote in part (a).
- 25. Reason** The table shows the main dishes served each day at a cafeteria.

Monday	hamburger, salad, pizza
Tuesday	hamburger, stir fry, pizza
Wednesday	fish and chips, stir fry, salad
Thursday	stir fry, salad, tacos
Friday	fish and chips, tacos, pizza

Suppose you know that Joshua has a salad and Nora has stir fry. Is that enough information to determine what day it is? If not, what other piece of information can help you?

ASSESSMENT PRACTICE

- 26.** The following statements are true.

- If you are over 54 inches tall, you can ride on the roller coasters.
- If you can ride on the roller coasters, then you can go on the drop tower.
- Cindy is 56 inches tall.

Classify each of the following statements as *true* or *false*.

- If Cindy can go on the drop tower, then she can ride the roller coasters.
- Cindy can go on the drop tower.
- Cindy can ride the roller coasters.
- If Cindy rides on the roller coasters, then she goes on the drop tower.

- 27. SAT/ACT** Which statement can you conclude from the given true statements?

If you ride your bike to school, you exercise. If you exercise, you are happy.

- If you are happy, you exercise.
- You exercise.
- If you exercise, you ride your bike.
- If you bike to school, you are happy.

- 28. Performance Task** In a game of exploration, rolling a cube numbered from 1 to 6 simulates asset acquisition. Some rules are listed.

- If you roll an even number, you get 1 red chip.
- If you roll a factor of 6, you get 1 blue chip.
- If you roll a number greater than 3, you get 1 green chip.
- If you get 2 green chips, then you exchange the 2 green chips for 1 purple chip.
- If you get 2 red chips, then you exchange the 2 red chips for 1 purple chip.



Note that a roll can earn more than one chip.

Part A Jacinta rolls a 2, 5, 1, and then 3. What chips does she have?

Part B After four rolls, Kimberly has 1 purple chip, 1 green chip, 3 blue chips, and no red chips. What numbers could she have rolled?