

WORD PROBLEMS

Lesson 4 Negative Number Word Problems

All the problems in this set involve negative numbers.

Some of the explanations for the example problems are quite long because they show more than one way to solve the problem. Read all the way through these explanations because you may find one way to get the answer easier to understand than another.

Entering Negative Numbers on the Calculator

Use the $+/-$ key to enter a negative number on the calculator. To enter -5 , press the 5 key, then the $+/-$ key. Don't enter the $+/-$ key before the number, and don't use the subtraction key.

If you need a review of how to work with negative numbers, see Lesson 2 in the Algebra section.

Temperature Notation

Don't be confused by the way temperatures are expressed. They can be shown as degrees Celsius or degrees Fahrenheit, with the words written out or using the degree symbol.

12°F is the same as 12 degrees Fahrenheit.

3°C is the same as 3 degrees Celsius.

Celsius and Fahrenheit are two different scales for measuring temperature. As long as the same scale is used throughout your problem, no conversions are needed and you can add and subtract the temperatures as regular numbers.

A.M. and P.M. Time Notation

Times are expressed as A.M. or P.M.

A.M. times are from midnight until noon.

P.M. times are from noon until midnight.

12:00 NOON and 12:00 MIDNIGHT are technically neither A.M. nor P.M.

12:00 P.M. is sometimes used for noon, and 12:00 A.M. is sometimes used for midnight, but in these problems, the word noon or midnight will be written out.

Example 1 – Calculate the Amount of Temperature Change

Brittany checked the temperature at 11:00 P.M. before she went to bed, and the thermometer read -3°F . She checked again at 9:30 A.M. the next morning, and the thermometer read 12°F . How many $^{\circ}\text{F}$ had the temperature increased overnight?

- A. 9 B. 4 C. 12 D. 15 E. 10

Subtract the low from the high to get the amount of temperature increase.

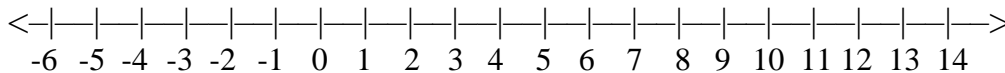
$$12^{\circ} - (-3^{\circ}) = 15^{\circ}$$

Answer: D. 15

OR

Visualize the amount of increase on a thermometer or number line. Move 3 spaces up (on a thermometer) or to the right (on a number line) to get from the starting point of -3° up to 0° , and 12 more spaces up or to the right to get from 0° to the ending point of 12° , for a total of $3 + 12 = 15$ spaces moved.

————— **15 spaces from -3 to 12** —————



Example 2 – Calculate the Distance Between a High and a Low Point

The highest point at Red Rock Recreational center is the top of Tremont Hill which is 450 feet above sea level. The lowest point is Explorer Cave, an underwater cave that is 65 feet below sea level. What is the difference in height between Tremont Hill and Explorer Cave?

- A. 385 ft. B. 551 ft. C. 358 ft. D. 525 ft. E. 515 ft.

In problems that refer to places above sea level and below sea level, think of sea level as 0 on a number line. The heights above sea level are positive numbers to the right of 0 and the heights below sea level are negative numbers to the left of 0.

To get the difference in height, subtract the low point from the high point.

$$450 \text{ ft.} - (-65 \text{ ft.}) = 515 \text{ ft.}$$

Answer: E. 515 ft.

OR

Think of traveling 65 feet up from Explorer Cave to get to sea level, and then traveling 450 feet further to get to the top of Tremont Hill. Total distance traveled between the two points is $65 \text{ ft.} + 450 \text{ ft.} = \mathbf{515 \text{ ft.}}$

Example 3 – Calculate an Ending Temperature

The temperature in Acton was 8° Celsius at 11:00 P.M., and was expected to go down through the night at an average rate of 2° Celsius per hour. Assuming the prediction was right, what was the temperature in °Celsius in Acton at 6:00 A.M.?

- A. 14 B. -14 C. -6 D. 6 E. 10

Start with 8° Celsius at 11:00 P.M. and go down 2 degrees each hour until you get to 6:00 A.M. Write out a list, making sure to subtract 2 degrees each hour.

11:00 P.M.	8°
12:00 MIDNIGHT	6°
1:00 A.M.	4°
2:00 A.M.	2°
3:00 A.M.	0°
4:00 A.M.	-2°
5:00 A.M.	-4°
6:00 A.M.	-6°

Answer: C. -6

OR

Here is a more traditional mathematical solution.

Step 1 Determine how many hours there are between 11:00 P.M. and 6:00 A.M.

Think of a clock, where it is 1 hour from 11:00 P.M. until 12:00 MIDNIGHT, and then 6 more hours from 12:00 MIDNIGHT until 6:00 A.M., for a total of 7 hours.

You can also count on your fingers. Start at 11:00 P.M. until 12:00 MIDNIGHT as 1 hour, and then count 1 finger for each hour until you get to 6:00 A.M., for a total of 7 hours.

Step 2 Calculate how many degrees the temperature fell. The time period is 7 hours (from Step 1) and the rate is 2° each hour (given in the problem), so $7 \times 2^\circ = 14^\circ$.

Step 3 Start with the beginning 8° temperature, and subtract 14°.

$8^\circ - 14^\circ = -6^\circ$ **Answer: C. -6**

Example 4 – Calculate the Rate of Temperature Change

The temperature in Rye was -5°F at 7:00 A.M., and rose to 7°F by 3:00 P.M. that afternoon. What was the average temperature increase per hour in $^{\circ}\text{F}$ between 7:00 A.M. and 3:00 P.M.?

- A. 1 B. 1.5 C. 2 D. 2.5 E. 3

Step 1 Calculate how many degrees the temperature rose.

Subtract high temperature minus low temperature. $7^{\circ} - (-5^{\circ}) = 12^{\circ}$.

You can also visualize a thermometer or number line. If you start at -5°F , you need to move 5 degrees to get up to 0°F , and then move 7 more degrees to get to the ending temperature of 7°F , for a total of $5 + 7 = 12$ degrees moved.

Step 2 Determine how many hours are between 7:00 A.M. and 3:00 P.M.

Think of a clock where it is 5 hours from 7:00 A.M. until 12:00 NOON, and then 3 more hours from 12:00 NOON until 3:00 P.M., for a total of **8 hours**.

You can also count on your fingers. Start at 7:00 A.M. until 8:00 A.M. as 1 hour, and then count 1 finger for each hour until 3:00 P.M., for a total of 8 hours.

Step 3 Divide the number of degrees the temperature increased by the number of hours to get the average temperature increase per hour.

$12^{\circ} \div 8 = 1.5^{\circ}$ **Answer: B. 1.5**

OR

Use the trial and error method with the answer choices that are given.

Start with -5°F at 7:00 A.M., and test each answer until you find the one that brings you to the desired ending temperature of 7°F at 3:00 P.M.

Try A. 1° increase per hour

7:00 A.M.	-5°
8:00 A.M.	-4°
9:00 A.M.	-3°
10:00 A.M.	-2°
11:00 A.M.	-1°
12:00 NOON	0°
1:00 P.M.	1°
2:00 P.M.	2°
3:00 P.M.	3°

It is not 7° at 3:00 P.M.

A. 1° is not correct.

Try B. 1.5° increase per hour

7:00 A.M.	-5°
8:00 A.M.	-3.5°
9:00 A.M.	-2°
10:00 A.M.	-0.5°
11:00 A.M.	1°
12:00 NOON	2.5°
1:00 P.M.	4°
2:00 P.M.	5.5°
3:00 P.M.	7°

It is 7° at 3:00 P.M.

B. 1.5° is correct.

NOTE: In problems like Example 4 above, that ask for the “average temperature decrease per hour,” don’t be confused by the use of the word average. You are not doing the kind of average calculation you are probably used to where you add up a group of numbers and divide by how many numbers were added.

The word average in this type of problem is used because the temperature will not decrease the exact same amount each hour. The rate you calculate will automatically be an average of all the individual hourly temperature decreases because you are dividing the total degree change by the total number of hours

Example 5 – Calculate the Difference Between a High and a Low Temperature

Temperature records for Fairbanks, Alaska show that in 2016 the high temperature was 35 degrees Fahrenheit, and the low temperature was -20 degrees Fahrenheit. What is the difference in $^{\circ}\text{F}$ between the high and the low temperatures?

- A. 15 B. 18 C. 65 D. 55 E. 56

Subtract the low from the high to get the difference between the two temperatures.

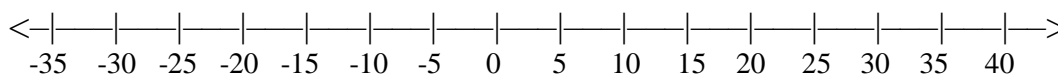
$$35^{\circ} - (-20^{\circ}) = 55^{\circ}$$

Answer: D. 55

OR

Think of the difference between the two temperatures as the distance you would have to travel on a thermometer or a number line to get from the low temperature to the high temperature.

To get from -20 to 0 you’d have to travel 20 units up (on a thermometer) or to the right (on a number line), and then to get from 0 to 35 , you’d have to travel 35 more units up or to the right, for a total of $20 + 35 = 55$ units traveled.



1. The temperature on Louisa’s backyard thermometer was 19°F at 8:00 A.M., and when she checked again at 6:00 P.M., the temperature had gone down to -11°F . What was the average temperature decrease per hour in $^{\circ}\text{F}$ between 8:00 A.M. and 6:00 P.M.?

A. 8 B. 2 C. 3 D. 30 E. 10
2. The temperature was -3°F when Alisa woke up at 6:00 A.M., and was expected to increase by a rate of 2°F per hour during the day. What is the predicted temperature in $^{\circ}\text{F}$ at 3:00 P.M. that afternoon?

A. 9 B. 15 C. -15 D. 12 E. 5
3. Mount Findley is 16,520 feet above sea level and Stanhope Valley is 195 feet below sea level. What is the difference in height between Mount Findley and Stanhope Valley? (Hint: think of sea level as 0 feet.)

A. 16,325 ft. B. 16,000 ft. C. 16,517 ft. D. 15,715 ft. E. 16,715 ft.
4. At 10:00 P.M. the temperature in Buffalo was -6°F . By 10:00 A.M. the temperature had risen to 8°F . How many degrees Fahrenheit did the temperature rise overnight?

A. 14 B. 2 C. 12 D. 15 E. 5
5. The lowest point of Sandy Shoal State Park is 75 feet below sea level, and the highest point is 900 feet above sea level. What is the difference in height between the highest and lowest points?

A. 825 ft. B. 957 ft. C. 852 ft. D. 975 ft. E. 850 ft.
6. The temperature in Boone was -2°C at 5:00 A.M. and had risen to 8°C by 3:00 P.M. What was the per hour rate of temperature increase in $^{\circ}\text{C}$ from 5:00 A.M. to 3:00 P.M.?

A. 10 B. 1 C. 1.5 D. 2 E. 6
7. A science experiment predicted that a beaker of chemical solution would decrease in temperature by a rate of 2 degrees Celsius per hour. The temperature was 12 degrees Celsius at 10:00 A.M. If the prediction was correct, what was the temperature in degrees Celsius at 7:00 P.M.?

A. 12 B. -6 C. 6 D. 9 E. 10

8. Mr. Ahmed's science class sampled the temperatures of many chemical solutions under different experimental conditions. The highest temperature found was 68°F and the lowest temperature found was -18°F . What was the range of temperatures sampled in $^{\circ}\text{F}$?

- A. 86 B. 40 C. 50 D. 68 E. 85

9. The temperature in Natick is 15 degrees Fahrenheit at 10:00 P.M., and is predicted to decrease by an average of 2.5 degrees Fahrenheit per hour through the night. What temperature should you expect to find at 6:00 A.M. in degrees Fahrenheit?

- A. 5 B. -20 C. 20 D. 6 E. -5

10. Jackie's class recorded temperatures at 9:00 A.M. every school day for the entire school year. The highest temperature was 25 degrees Celsius and the lowest temperature was -12 degrees Celsius. What was the range between the highest and lowest temperature in degrees Celsius?

- A. 13 B. 31 C. 37 D. 73 E. 38

11. The temperature in a city decreased from 16°F at 6:00 P.M. to -6°F at 5:00 A.M. the next morning. What was the average rate of temperature decrease per hour in $^{\circ}\text{F}$ between 6:00 P.M. and 5:00 A.M.?

- A. 1 B. 2.5 C. 2 D. 10 E. 1.5

12. The temperature in Dover is -4 degrees Fahrenheit at 4:00 A.M. and is expected to rise at a rate of 3 degrees Fahrenheit per hour through the day. What do you predict the temperature will be at 2:00 P.M. in degrees Fahrenheit?

- A. 34 B. 30 C. 26 D. -30 E. -26

13. The temperature of a chemical solution was -4°C at 9:00 P.M. when Leo left his laboratory. When he returned at 6:00 A.M. the temperature had risen to 14°C . What was the average hourly temperature increase in $^{\circ}\text{C}$ between 9:00 P.M. and 6:00 A.M.?

- A. 1.5 B. 2 C. 1 D. 10 E. 18

ANSWER KEY Lesson 4 Negative Number Word Problems

1. The temperature on Louisa's backyard thermometer was 19°F at 8:00 A.M., and when she checked again at 6:00 P.M., the temperature had gone down to -11°F . What was the average temperature decrease per hour in $^{\circ}\text{F}$ between 8:00 A.M. and 6:00 P.M.?

- A. 8 B. 2 C. 3 D. 30 E. 10

Calculate the amount of temperature decrease and the number of hours, then divide.

Step 1 Subtract high temperature minus low temperature.

$$19^{\circ} - (-11^{\circ}) = 30^{\circ}. \text{ Temperature decrease is } 30^{\circ}.$$

Or, visualize the distance between 19 and -11 on a number line.

Step 2 Number of hours is $4 + 6 = 10$.

4 hours from 8:00 A.M. until 12:00 NOON, plus 6 hours from 12:00 NOON until 6:00 P.M.

Step 3 Divide $30^{\circ} \div 10 = 3^{\circ}$. **ANSWER: C. 3**

OR

Use trial and error. Start with 19°F at 8:00 A.M., and test each answer until you find the one that brings you to the desired ending temperature of -11°F at 6:00 P.M.

**Try A. 8° decrease
per hour**

8:00 A.M.	19°
9:00 A.M.	11°
10:00 A.M.	3°
11:00 A.M.	-5°
12:00 NOON	-13°
1:00 P.M.	-21°
2:00 P.M.	-29°
3:00 P.M.	-37°
4:00 P.M.	-45°
5:00 P.M.	-53°
6:00 P.M.	-61°

It is not -11° at 6:00 P.M.

A. 8° is not correct.

**Try B. 2° decrease
per hour**

8:00 A.M.	19°
9:00 A.M.	17°
10:00 A.M.	15°
11:00 A.M.	13°
12:00 NOON	11°
1:00 P.M.	9°
2:00 P.M.	7°
3:00 P.M.	5°
4:00 P.M.	3°
5:00 P.M.	1°
6:00 P.M.	-1°

It is not -11° at 6:00 P.M.

B. 2° is not correct.

**Try C. 3° decrease
per hour**

8:00 A.M.	19°
9:00 A.M.	16°
10:00 A.M.	13°
11:00 A.M.	10°
12:00 NOON	7°
1:00 P.M.	4°
2:00 P.M.	1°
3:00 P.M.	-2°
4:00 P.M.	-5°
5:00 P.M.	-8°
6:00 P.M.	-11°

It is -11° at 6:00 P.M.

C. 3° is correct.

2. The temperature was -3°F when Alisa woke up at 6:00 A.M., and was expected to increase by a rate of 2°F per hour during the day. What is the predicted temperature in $^{\circ}\text{F}$ at 3:00 P.M. that afternoon?

- A. 9 B. **15** C. -15 D. 12 E. 5

Start with -3°F at 6:00 A.M. and add 2 degrees every hour until you get to 3:00 P.M.

6:00 A.M.	-3°
7:00 A.M.	-1°
8:00 A.M.	1°
9:00 A.M.	3°
10:00 A.M.	5°
11:00 A.M.	7°
12:00 NOON	9°
1:00 P.M.	11°
2:00 P.M.	13°
3:00 P.M.	15°

ANSWER: B. 15

OR

Calculate number of hours, calculate temperature increase, and add that many degrees to the starting temperature.

Step 1 Number of hours is $6 + 3 = 9$.

6 hours from 6:00 A.M. until 12:00 NOON, plus 3 hours from 12:00 NOON until 3:00 P.M.

Step 2 Temperature increase is 2° per hour \times 9 hours = 18° .

Step 3 Add to starting temperature: $-3^{\circ} + 18^{\circ} = 15^{\circ}$. **ANSWER: B. 15**

3. Mount Findley is 16,520 feet above sea level and Stanhope Valley is 195 feet below sea level. What is the difference in height between Mount Findley and Stanhope Valley? (Hint: Think of sea level as 0 feet.)

- A. 16,325 ft. B. 16,000 ft. C. 16,517 ft. D. 15,715 ft. E. **16,715 ft.**

Subtract the low point from the high point. Think of a below sea level height as a negative number and an above sea level height as a positive number.

$16,520 \text{ ft.} - (-195 \text{ ft.}) = 16,715 \text{ ft.}$ **ANSWER: E. 16,715 ft**

OR

Visualize traveling 195 feet from the low point to get up to sea level, plus another 16,520 feet to get from sea level to the high point, for a total distance traveled of $195 \text{ ft.} + 16,520 \text{ ft.} = 16,715 \text{ ft.}$

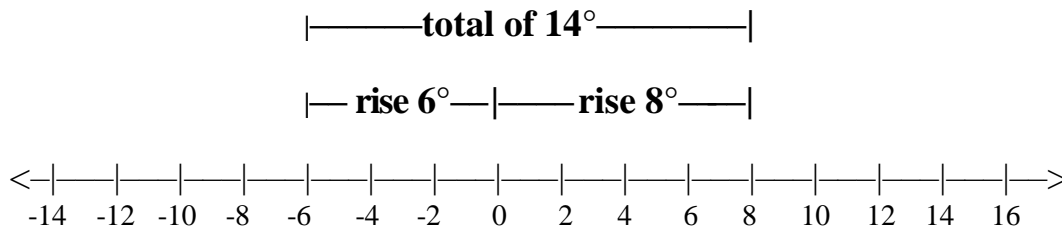
4. At 10:00 P.M. the temperature in Buffalo was -6°F . By 10:00 A.M. the temperature had risen to 8°F . How many degrees Fahrenheit did the temperature rise overnight?
 A. 14 B. 2 C. 12 D. 15 E. 5

Subtract the low temperature from the high temperature.

$8^{\circ} - (-6^{\circ}) = 14^{\circ}$ **ANSWER: A. 14**

OR

Visualize rising 6 degrees from the -6°F low temperature to get up to 0°F , plus another 8 degrees to get from 0°F to the high temperature of 8°F , for a total rise of $6^{\circ} + 8^{\circ} = 14^{\circ}$. Drawing a number line may be helpful.



5. The lowest point of Sandy Shoal State Park is 75 feet below sea level, and the highest point is 900 feet above sea level. What is the difference in height between the highest and lowest points?
 A. 825 ft. B. 957 ft. C. 852 ft. **D. 975 ft.** E. 850 ft.

Subtract the low point from the high point.

$900 \text{ ft.} - (-75 \text{ ft.}) = 975 \text{ ft.}$ **ANSWER: D. 975 ft.**

OR

Visualize traveling 75 feet from the low point to get up to sea level plus another 900 feet to get from sea level to the high point, for a total distance traveled of $75 \text{ ft.} + 900 \text{ ft.} = 975 \text{ ft.}$

6. The temperature in Boone was -2°C at 5:00 A.M. and had risen to 8°C by 3:00 P.M. What was the per hour rate of temperature increase in $^{\circ}\text{C}$ from 5:00 A.M. to 3:00 P.M.?
 A. 10 **B. 1** C. 1.5 D. 2 E. 6

Calculate the amount of temperature increase and the number of hours, then divide.

Step 1 Subtract high temperature minus low temperature.

$$8^{\circ} - (-2^{\circ}) = 10^{\circ}. \text{ Temperature increase is } 10^{\circ}.$$

Or, visualize the distance between -2 and 8 on a number line.

Step 2 Number of hours is $7 + 3 = 10$.

7 hours from 5:00 A.M. until 12:00 NOON, plus 3 hours from 12:00 NOON until 3:00 P.M.

Step 3 Divide $10^{\circ} \div 10 = 1^{\circ}$

ANSWER: B. 1

OR

Use the trial and error method. Start with -2°C at 5:00 A.M., and test each answer until you find the one that brings you to the desired ending temperature of 8°C at 3:00 P.M.

Try A. 10° increase per hour

5:00 A.M.	-2°
6:00 A.M.	8°
7:00 A.M.	18°
8:00 A.M.	28°
9:00 A.M.	38°
10:00 A.M.	48°
11:00 A.M.	58°
12:00 NOON	68°
1:00 P.M.	78°
2:00 P.M.	88°
3:00 P.M.	98°

It is not 8° at 3:00 P.M.

A. 10° is not correct.

Try B. 1° increase per hour

5:00 A.M.	-2°
6:00 A.M.	-1°
7:00 A.M.	0°
8:00 A.M.	1°
9:00 A.M.	2°
10:00 A.M.	3°
11:00 A.M.	4°
12:00 NOON	5°
1:00 P.M.	6°
2:00 P.M.	7°
3:00 P.M.	8°

It is 8° at 3:00 P.M.

B. 1° is correct.

7. A science experiment predicted that a beaker of chemical solution would decrease in temperature by a rate of 2 degrees Celsius per hour. The temperature was 12 degrees Celsius at 10:00 A.M. If the prediction was correct, what was the temperature in degrees Celsius at 7:00 P.M.?

- A. 12 B. -6 C. 6 D. 9 E. 10

Start with 12°C at 10:00 A.M. and subtract 2 degrees every hour until you get to 7:00 P.M.

10:00 A.M.	12°
11:00 A.M.	10°
12:00 NOON	8°
1:00 P.M.	6°
2:00 P.M.	4°
3:00 P.M.	2°
4:00 P.M.	0°
5:00 P.M.	-2°
6:00 P.M.	-4°
7:00 P.M.	-6°

ANSWER: B. -6

OR

Calculate number of hours, calculate temperature decrease, and subtract that many degrees from the starting temperature.

Step 1 Number of hours is $2 + 7 = 9$.

2 hours from 10:00 A.M. until 12:00 NOON plus 7 hours from 12:00 NOON until 7:00 P.M.

Step 2 Temperature decrease is 2° per hour \times 9 hours = 18° .

Step 3 Subtract from starting temperature: $12^\circ - 18^\circ = -6^\circ$. **ANSWER: B. -6**

8. Mr. Ahmed's science class sampled the temperatures of many chemical solutions under different experimental conditions. The highest temperature found was 68°F and the lowest temperature found was -18°F. What was the range of temperatures sampled in °F?

- A. 86 B. 40 C. 50 D. 68 E. 85

Range means the distance between the high and low points.

Subtract the low temperature from the high temperature.

$68^\circ - (-18^\circ) = 86^\circ$ **ANSWER: A. 86**

OR

Visualize rising 18 degrees from the -18°F low temperature to get up to 0°F, plus another 68 degrees to get from 0°F to the high temperature of 68°F, for a total range of $18^\circ + 68^\circ = 86^\circ$.

9. The temperature in Natick is 15 degrees Fahrenheit at 10:00 P.M., and is predicted to decrease by an average of 2.5 degrees Fahrenheit per hour through the night. What temperature should you expect to find at 6:00 A.M. in degrees Fahrenheit?

- A. 5 B. -20 C. 20 D. 6 E. -5

Start with 15°F at 10:00 P.M. and subtract 2.5 degrees each hour until you get to 6:00 A.M.

10:00 P.M.	15°
11:00 P.M.	12.5°
12:00 MIDNIGHT	10°
1:00 A.M.	7.5°
2:00 A.M.	5°
3:00 A.M.	2.5°
4:00 A.M.	0°
5:00 A.M.	-2.5°
6:00 A.M.	-5°

ANSWER: E. -5

OR

Calculate number of hours, calculate temperature decrease, and subtract that many degrees from the starting temperature.

Step 1 Number of hours is $2 + 6 = 8$.

2 hours from 10:00 P.M. until 12:00 MIDNIGHT, plus 6 hours from 12:00 MIDNIGHT until 6:00 A.M.

Step 2 Temperature decrease is 2.5° per hour \times 8 hours = 20° .

Step 3 Subtract from starting temperature: $15^\circ - 20^\circ = -5^\circ$. **ANSWER: E. -5**

10. Jackie's class recorded temperatures at 9:00 A.M. every school day for the entire school year. The highest temperature was 25 degrees Celsius and the lowest temperature was -12 degrees Celsius. What was the range between the highest and lowest temperature in degrees Celsius?

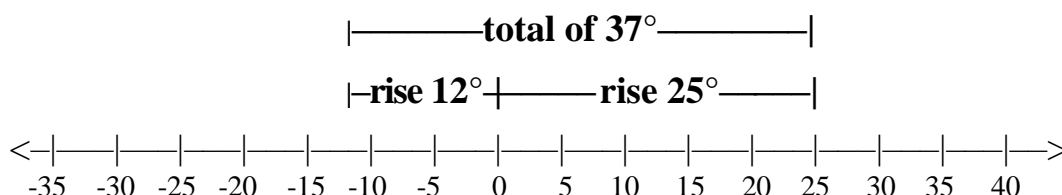
- A. 13 B. 31 C. 37 D. 73 E. 38

Subtract the low temperature from the high temperature.

$25^\circ - (-12^\circ) = 37^\circ$ **ANSWER: C. 37**

OR

Visualize rising 12 degrees from the -12°C low temperature to get up to 0°C , then rising another 25 degrees to get from 0°C to the high temperature of 25°C , for a total range of $12^\circ + 25^\circ = 37^\circ$. Drawing a number line may be helpful.



11. The temperature in a city decreased from 16°F at 6:00 P.M. to -6°F at 5:00 A.M. the next morning. What was the average rate of temperature decrease per hour in $^{\circ}\text{F}$ between 6:00 P.M. and 5:00 A.M.?

- A. 1 B. 2.5 C. 2 D. 10 E. 1.5

Calculate the amount of temperature decrease and the number of hours, then divide.

Step 1 Subtract high temperature minus low temperature.

$$16^{\circ} - (-6^{\circ}) = 22^{\circ}. \text{ Temperature decrease is } 22^{\circ}.$$

Or, visualize the distance between -6 and 16 on a number line.

Step 2 Number of hours is $6 + 5 = 11$.

6 hours from 6:00 P.M. until 12:00 MIDNIGHT, plus 5 hours from 12:00 MIDNIGHT until 5:00 A.M.

Step 3 Divide $22^{\circ} \div 11 = 2^{\circ}$. **ANSWER: C. 2**

OR

Use trial and error. Start with 16°F at 6:00 P.M., and test each answer until you find the one that brings you to the desired ending temperature of -6°F at 5:00 A.M.

Try A. 1° decrease per hour

6:00 P.M.	16°
7:00 P.M.	15°
8:00 P.M.	14°
9:00 P.M.	13°
10:00 P.M.	12°
11:00 P.M.	11°
12:00 MIDNIGHT	10°
1:00 A.M.	9°
2:00 A.M.	8°
3:00 A.M.	7°
4:00 A.M.	6°
5:00 A.M.	5°

It is not -6° at 5:00 A.M.

A. 1° is not correct.

Try B. 2.5° decrease per hour

6:00 P.M.	16°
7:00 P.M.	13.5°
8:00 P.M.	11°
9:00 P.M.	8.5°
10:00 P.M.	6°
11:00 P.M.	3.5°
12:00 MIDNIGHT	1°
1:00 A.M.	-1.5°
2:00 A.M.	-4°
3:00 A.M.	-6.5°
4:00 A.M.	-9°
5:00 A.M.	-11.5°

It is not -6° at 5:00 A.M.

B. 2.5° is not correct.

Try C. 2° decrease per hour

6:00 P.M.	16°
7:00 P.M.	14°
8:00 P.M.	12°
9:00 P.M.	10°
10:00 P.M.	8°
11:00 P.M.	6°
12:00 MIDNIGHT	4°
1:00 A.M.	2°
2:00 A.M.	0°
3:00 A.M.	-2°
4:00 A.M.	-4°
5:00 A.M.	-6°

It is -6° at 5:00 A.M.

C. 2° is correct.

12. The temperature in Dover is -4 degrees Fahrenheit at 4:00 A.M. and is expected to rise at a rate of 3 degrees Fahrenheit per hour through the day. What do you predict the temperature will be at 2:00 P.M. in degrees Fahrenheit?

- A. 34 B. 30 C. **26** D. -30 E. -26

Start with -4°F at 4:00 A.M. and add 3 degrees every hour until you get to 2:00 P.M.

4:00 A.M.	-4°
5:00 A.M.	-1°
6:00 A.M.	2°
7:00 A.M.	5°
8:00 A.M.	8°
9:00 A.M.	11°
10:00 A.M.	14°
11:00 A.M.	17°
12:00 NOON	20°
1:00 P.M.	23°
2:00 P.M.	26°

ANSWER: C. 26

OR

Calculate number of hours, calculate temperature increase, and add that many degrees to the starting temperature.

Step 1 Number of hours is $8 + 2 = 10$.

8 hours from 4:00 A.M. until 12:00 NOON, plus 2 hours from 12:00 NOON until 2:00 P.M.

Step 2 Temperature increase is 3° per hour \times 10 hours = 30° .

Step 3 Add to starting temperature: $-4^{\circ} + 30^{\circ} = 26^{\circ}$. **ANSWER: C. 26**

13. The temperature of a chemical solution was -4°C at 9:00 P.M. when Leo left his laboratory. When he returned at 6:00 A.M. the temperature had risen to 14°C . What was the average hourly temperature increase in $^{\circ}\text{C}$ between 9:00 P.M. and 6:00 A.M.?

- A. 1.5 **B. 2** C. 1 D. 10 E. 18

Calculate the amount of temperature increase and the number of hours, then divide.

Step 1 Subtract high temperature minus low temperature.

$$14^{\circ} - (-4^{\circ}) = 18^{\circ}. \text{ Temperature increase is } 18^{\circ}.$$

Or, visualize the distance between -4 and 14 on a number line.

Step 2 Number of hours is $3 + 6 = 9$.

3 hours from 9:00 P.M. until 12:00 MIDNIGHT, plus 6 hours from 12:00 MIDNIGHT until 6:00 A.M.

Step 3 Divide $18^{\circ} \div 9 = 2^{\circ}$. **ANSWER: B. 2**

OR

Use the trial and error method. Start with -4°C at 9:00 P.M., and test each answer until you find the one that brings you to the desired ending temperature of 14°C at 6:00 A.M.

**Try A. 1.5° increase
per hour**

9:00 P.M.	-4°
10:00 P.M.	-2.5°
11:00 P.M.	-1°
12:00 MIDNIGHT	0.5°
1:00 A.M.	2°
2:00 A.M.	3.5°
3:00 A.M.	5°
4:00 A.M.	6.5°
5:00 A.M.	8°
6:00 A.M.	9.5°

It is not 14° at 6:00 A.M.

A. 1.5° is not correct.

**Try B. 2° increase
per hour**

9:00 P.M.	-4°
10:00 P.M.	-2°
11:00 P.M.	0°
12:00 MIDNIGHT	2°
1:00 A.M.	4°
2:00 A.M.	6°
3:00 A.M.	8°
4:00 A.M.	10°
5:00 A.M.	12°
6:00 A.M.	14°

It is 14° at 6:00 A.M.

B. 2° is correct.