Math 7 Unit 1 quiz 2: Distance on a number line, Temperatures below zero and temperature change (answer key)

8 questions, 21 points

ANSWERS AT A GLANCE

1. 68 meters
2. $JK = 160$
3. No. It must have started above 7°C.
4. (a) 18.5 (b) He added the two distances to zero, but both points are left of zero; the distance is $3\frac{5}{12}$.
5. (a) The point x is 7 units from 2. (b) $x = 9$ or $x = -5$
6. (a) −56 degrees, a fall of 56 degrees (b) colder, by 4 degrees
7. (a) −7, −8, −5, −2; the biggest fall was from 5 to 10 minutes. (b) −22 degrees, and −7 + (−8) + (−5) + (−2) = −22.
8. (a) The readings are on different scales, so subtracting them means nothing. (b) Toronto, by 3 Fahrenheit degrees.

WORKED SOLUTIONS

1. In a long, straight school hallway, doors are placed by their distance in meters from the main office door, with east positive and west negative. Aisha leaves the art room door at −30 and walks to the gym door at 19. Then Aisha walks from the gym door back to the main office door. How many meters does Aisha walk in all? (2 points)

ANSWER

68 meters

SOLUTION

First walk: $|19 - (-30)| = 19 + 30 = 49$ m.

Second walk: $|0 - 19| = 19$ m.

In all: 49 + 19 = 68 meters.

SCORING

1 point for the first walk, 49 m; 1 point for the total 68 meters.

2. A number line is marked every 20 units, and only 0 is labeled. Point J is on the third mark to the left of 0, and point K is on the fifth mark to the right of 0. Find JK. (2 points)

ANSWER

$JK = 160$

SOLUTION

Each mark is 20 units, so J is at 3 × (−20) = −60 and K is at 5 × 20 = 100.

$$JK = |100 - (-60)| = |100 + 60| = 160$$

The 8 gaps between the marks are 8 × 20 = 160 units, not 8.

SCORING

1 point for the coordinates −60 and 100; 1 point for $JK = 160$.

3. The temperature fell 7 degrees, and afterwards it was above 0°C. Grace says it might have started below zero. Is she right? Explain, using earlier = later − change. (2 points)

ANSWER

No. It must have started above 7°C.

SOLUTION

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A fall of 7 is a change of −7, so earlier = later −(−7) = later + 7. The later reading is above 0, so the earlier one is more than 0 + 7 = 7. The temperature started above 7°C, not below zero, so Grace is wrong.

On the thermometer: going back up 7 degrees from any reading above zero lands even higher above zero.

SCORING

1 point for earlier = later + 7 (or the same idea on the thermometer). 1 point for concluding that it started above 7°C, so Grace is wrong.

4. (3 points)

(a) Find the distance between the points at −13.6 and 4.9.

(b) Kevin says the points at $-2\frac{1}{4}$ and $-5\frac{2}{3}$ are $7\frac{11}{12}$ units apart. Explain what he did wrong, and find the correct distance.

ANSWER

(a) 18.5 (b) He added the two distances to zero, but both points are left of zero; the distance is $3\frac{5}{12}$.

SOLUTION

(a) $|4.9 - (-13.6)| = |4.9 + 13.6| = 18.5$.

(b) $2\frac{1}{4} + 5\frac{2}{3} = 7\frac{11}{12}$, so Kevin added the two distances to zero. That works only for points on opposite sides of zero. Here both points are negative, so the stretch from $-2\frac{1}{4}$ to 0 is counted twice. Subtract instead, with $-2\frac{1}{4} = -\frac{9}{4}$ and $-5\frac{2}{3} = -\frac{17}{3}$:

$$\left|-\frac{9}{4} - \left(-\frac{17}{3}\right)\right| = \left|-\frac{27}{12} + \frac{68}{12}\right| = \frac{41}{12} = 3\frac{5}{12}$$

SCORING

(a) 1 point for 18.5. (b) 1 point for saying he added the distances to zero although both points are on the same side of zero; 1 point for $3\frac{5}{12}$ (or $\frac{41}{12}$).

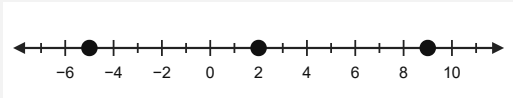
5. (3 points)

(a) Write the equation $|x - 2| = 7$ as a sentence about distance on a number line.

(b) Find every value of x that makes it true.

ANSWER

(a) The point x is 7 units from 2. (b) $x = 9$ or $x = -5$



SOLUTION

(a) $|x - 2|$ is the distance between the points at x and 2, so the equation says: the point x is 7 units away from 2.

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(b) There is one such point on each side of 2: 2 + 7 = 9 and 2 − 7 = −5. Check: $|9 - 2| = 7$ and $|-5 - 2| = |-7| = 7$.

SCORING

1 point for a sentence naming the distance between x and 2; 1 point for $x = 9$; 1 point for $x = -5$.

6. A rover on Mars recorded an afternoon high of −18°C. At dawn the next day it recorded a low of −74°C. (3 points)

(a) Find the change in temperature from the afternoon high to the dawn low, and say whether it is a rise or a fall.

(b) On the afternoon of that next day, the high was −22°C. Was it warmer or colder than the first afternoon's high, and by how many degrees?

ANSWER

(a) −56 degrees, a fall of 56 degrees (b) colder, by 4 degrees

SOLUTION

(a) Later minus earlier: −74 − (−18) = −74 + 18 = −56. The change is negative, so the temperature fell 56 degrees.

(b) −22 lies below −18 on the scale, so the second high was colder. The change from the first high to the second is −22 − (−18) = −22 + 18 = −4, so it was 4 degrees colder.

SCORING

(a) 2 points: 1 for later minus earlier written with the readings in the right order, 1 for the value with "fall". (b) 1 point: "colder" and the number of degrees, both correct.

7. In a science lab, Hiro cools a liquid in a cooling bath and reads its temperature every 5 minutes. (3 points)

Time (min)	0	5	10	15	20
Temperature (°C)	9	2	−6	−11	−13

(a) Find the change over each 5-minute interval. In which interval did the temperature fall the most?

(b) Find the change over the whole 20 minutes, and show that it equals the sum of the four changes.

ANSWER

(a) −7, −8, −5, −2; the biggest fall was from 5 to 10 minutes. (b) −22 degrees, and −7 + (−8) + (−5) + (−2) = −22.

SOLUTION

(a) Each change is later minus earlier:

0 to 5 min: 2 − 9 = −7. 5 to 10 min: −6 − 2 = −8.

10 to 15 min: −11 − (−6) = −11 + 6 = −5. 15 to 20 min: −13 − (−11) = −13 + 11 = −2.

The biggest fall is the change of largest size, −8, from 5 to 10 minutes, the interval that crossed zero.

(b) Over the whole time: −13 − 9 = −22, a fall of 22 degrees. The sum of the four changes is −7 + (−8) + (−5) + (−2) = −22, the same.

SCORING

(a) 2 points: 1 for all four changes correct, 1 for naming the 5 to 10 minute interval. (b) 1 point: −22 found and the sum of the four changes shown to match.

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8. At 8 a.m. a thermometer in the city of Toronto reads −5°C, and at the same moment a thermometer in the city of Buffalo, across the border, reads 20°F. Arjun says it is 25 degrees warmer in the second city, because 20 − (−5) = 25. (3 points)

(a) Explain what is wrong with Arjun's reasoning.

(b) −5°C is the same temperature as 23°F. Which city is warmer, and by how many Fahrenheit degrees?

ANSWER

(a) The readings are on different scales, so subtracting them means nothing. (b) Toronto, by 3 Fahrenheit degrees.

SOLUTION

(a) The Celsius and Fahrenheit scales put zero in different places and use degrees of different sizes. Both temperatures must be on the same scale before one is subtracted from the other, so 20 − (−5) is a meaningless number. A reading below zero Celsius need not be colder than a reading above zero Fahrenheit.

(b) On the Fahrenheit scale the first reading is 23 and the second 20. 23 is higher on the scale, so it was warmer in Toronto, by 23 − 20 = 3 Fahrenheit degrees.

SCORING

(a) 1 point: says the two readings are on different scales and must be on the same scale before subtracting. (b) 2 points: 1 for Toronto, 1 for 3 degrees.

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