

## Geometry on a Line — Modeling with Distances

*“Add segments carefully, measure distances precisely, and place points with intent.”*

### Mini-Review: Betweenness (Segment Addition)

If  $B$  is **between**  $A$  and  $C$  on a straight line, then  $\boxed{AB + BC = AC}$ .

### Mini-Review: Euclidean Distance

On a number line (1D): distance between  $x_1$  and  $x_2$  is  $|x_2 - x_1|$ .

In the plane (2D): distance between  $(x_1, y_1)$  and  $(x_2, y_2)$  is  $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ .

### Mini-Review: Placing a Point by Fraction or Ratio

Fraction  $f$  of the way from  $A$  to  $B$  (on a number line):  $P = A + f(B - A)$  ( $0 \leq f \leq 1$ ).

Partition with ratio  $AP : PB = m : n$  (directed  $A \rightarrow B$ ):  $P = A + \frac{m}{m+n}(B - A)$ .

1. (**Segment addition—warmup**) Bus stops  $A, B, C$  lie on one straight road with  $B$  between  $A$  and  $C$ . If  $AB = 1.8$  miles and  $BC = 2.4$  miles, find  $AC$ .

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2. (**Solve with a diagram-in-your-head**) On a number line,  $A = -5$  and  $C = 9$ . Point  $B$  is between them. If  $AB = 2x + 1$  and  $BC = 3x - 5$ , find  $x$  and the coordinate of  $B$ .

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3. (**Direction awareness**) On a number line,  $A = 12$  and  $C = -6$  (so  $C$  is left of  $A$ ). A point  $B$  lies between them with  $AB = 4 + k$  and  $BC = 2k$ . Find  $k$ , then the coordinate of  $B$ .

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4. **(2D distance)** A ranger walks from  $P(-3, 4)$  to  $Q(9, -8)$ . How far did the ranger travel? Give an exact answer (simplified radical).

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5. **(Coverage ring)** A cell tower is at  $(2, 5)$ . A device at  $(x, 1)$  is exactly 10 units away. Find all possible  $x$ -coordinates of the device.

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6. **(Fractional placement)** On a number line,  $A = -6$  and  $B = 10$ . Point  $P$  is  $\frac{3}{4}$  of the way from  $A$  to  $B$ . Find  $P$ .

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7. **(Gentle trap: negatives + fractions)** On a number line,  $A = -3$  and  $B = 9$ . Point  $P$  is  $\frac{1}{5}$  of the way from  $A$  to  $B$ . Find  $P$ .

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8. **(Highway sign)** Mile marker  $A$  is at 2, and mile marker  $B$  is at 14 on a straight highway. A sign is placed 60% of the way from  $A$  toward  $B$ . What mile marker is the sign at?

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9. **(Partition by ratio)** On a number line,  $A = 2$  and  $B = 18$ . Find the coordinate  $P$

that divides  $\overline{AB}$  in the ratio  $AP : PB = 3 : 5$  (directed from  $A$  to  $B$ ).

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10. (**Ratio + negatives**) On a number line,  $A = -12$  and  $B = 6$ . Find the coordinate  $P$  so that  $AP : PB = 1 : 3$  (directed  $A \rightarrow B$ ).

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11. (**Work backward from a partition**) On a number line,  $A = 4$  and point  $P = 10$  lies on the directed segment from  $A$  to  $B$  with  $AP : PB = 1 : 3$ . Find  $B$ .

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12. (**Ratio + segment addition together**) Points  $A = -2$  and  $C = 11$  are endpoints of a straight walkway, with  $B$  between them such that  $AB : BC = 2 : 3$ . Find the coordinate of  $B$ , then verify  $AB + BC = AC$ .

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13. (**Percent-of-length placement**) On a number line,  $A = -8$  and  $C = 7$ . Point  $P$  lies on  $\overline{AC}$  so that  $AP$  is 70% of  $AC$ . Find  $P$ .

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14. (**Another ratio for fluency**) On a number line,  $A = 1$  and  $B = 15$ . Find the coordinate

that partitions the directed segment  $A \rightarrow B$  in the ratio  $5 : 2$  (that is,  $AP : PB = 5 : 2$ ).

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