Calculus: CAI 2.0
Exercises on Line Equations and Distances

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Slope and Equation of a Line

1. Find the equation of the line passing through $(2, 5)$ and $(4, 9)$.
2. Determine the slope of the line $3x - 2y + 6 = 0$.
3. Write the equation of a line parallel to $y = 4x + 3$ that passes through the point $(-2, 1)$.
4. Find the equation of the line perpendicular to $y = -\frac{1}{3}x + 2$ that passes through $(0, -1)$.

Distance Between Two Points

1. Calculate the distance between the points $(3, 4)$ and $(7, 1)$.
2. Find the distance between the points $(-1, -2)$ and $(4, 6)$.
3. Determine the coordinates of a point on the line segment connecting $(1, 2)$ and $(5, 6)$ that divides it into two equal halves.
4. Verify if the points $(0, 0)$, $(3, 4)$, and $(6, 8)$ are collinear.

Determine If a Point Lies on a Line

1. Does the point $(2, 3)$ lie on the line $y = 2x + 1$?
2. Verify if the point $(4, 5)$ lies on the line $3x - 2y + 7 = 0$.
3. For the line passing through $(-1, -2)$ and $(3, 4)$, check if $(5, 8)$ lies on the same line.
4. Find the x-coordinate of the point that lies on the line $y = 3x - 4$ with $y = 5$.

Intersection of Lines

1. Find the intersection of the lines $x + y - 4 = 0$ and $2x - y + 1 = 0$.
2. Determine if the lines $3x + 4y - 5 = 0$ and $6x + 8y - 10 = 0$ are coincident, parallel, or intersecting.
3. A line $y = 2x - 1$ intersects the x-axis at $(a, 0)$. Find the value of a.

Challenge Problems

1. A triangle has vertices at $(0, 0)$, $(6, 0)$, and $(3, 4)$:
   (a) Find the equations of the three sides of the triangle.
   (b) Calculate the lengths of each side.
   (c) Verify if the triangle is a right triangle.
2. The midpoints of a line segment connecting (x_1, y_1) and (x_2, y_2) is $(2, 3)$. If $x_1 = 1$ and $y_2 = 5$, find x_2 and y_1.
3. Verify if the quadrilateral with vertices $(1, 1)$, $(4, 1)$, $(4, 5)$, and $(1, 5)$ is a rectangle.