Key Concepts & Formulas

- **Slope-Intercept Form:** $y = mx + b$

- **Point-Slope Form:** $y - y_1 = m(x - x_1)$

- **Slope Between Two Points:** $m = \frac{y_2 - y_1}{x_2 - x_1}$

- **Parallel Lines:** Same slope

- **Perpendicular Lines:** Slopes are negative reciprocals $(m_1 \cdot m_2 = -1)$

- **Standard Form:** $Ax + By = C$, with $A > 0$ and no fractions

Quick Reference Tips

- **Horizontal Line:** $y = c$

- **Vertical Line:** $x = c$

- **No Fractions in Standard Form**

Equations of a Straight Line – Practice Questions

Level: From Basic to Challenging

Topics Covered: Slope-Intercept Form, Point-Slope Form, Standard Form, and Applications

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1. Slope-Intercept Form

Question: Determine the equation of a line with slope 2 and y-intercept -3.

Solution:

$$y = mx + b \Rightarrow y = 2x - 3 \quad \boxed{y = 2x - 3}$$

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2. Point-Slope Form

Question: Find the equation of the line passing through the point $(4, -1)$ with slope $\frac{1}{2}$.

Solution:

$$y - (-1) = \frac{1}{2}(x - 4) \Rightarrow y + 1 = \frac{1}{2}x - 2 \Rightarrow \boxed{y = \frac{1}{2}x - 3}$$

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3. Using Two Points

Question: Write the equation of the line passing through $(2, 5)$ and $(-1, -4)$.

Solution:

1. Find the slope:

$$m = \frac{-4 - 5}{-1 - 2} = \frac{-9}{-3} = 3$$

2. Use point-slope form:

$$y - 5 = 3(x - 2) \Rightarrow y = 3x - 6 + 5 = \boxed{y = 3x - 1}$$

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4. Horizontal Line

Question: What is the equation of a horizontal line through $(7, -2)$?

Solution:

$$\text{Horizontal lines have slope } 0 \Rightarrow \boxed{y = -2}$$

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5. Vertical Line

Question: Write the equation of a vertical line passing through $(-3, 6)$.

Solution:

$$\text{Vertical lines have undefined slope} \Rightarrow \boxed{x = -3}$$

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6. Parallel Lines

Question: Find the equation of a line parallel to $y = -\frac{3}{4}x + 1$ that passes through $(8, 2)$.

Solution:

$$\text{Same slope: } m = -\frac{3}{4}$$
$$y - 2 = -\frac{3}{4}(x - 8) \Rightarrow y = -\frac{3}{4}x + 6 + 2 = \boxed{y = -\frac{3}{4}x + 8}$$

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7. Perpendicular Lines

Question: Determine the equation of the line perpendicular to $y = 2x - 5$ that passes through the origin.

Solution:

$$\text{Perpendicular slope: } m = -\frac{1}{2} \Rightarrow \boxed{y = -\frac{1}{2}x}$$

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8. Real-World Application

Question: A taxi fare includes a base charge of $3 and costs $2 per km. Write a linear equation and calculate the fare for 10 km.

Solution:

$$\text{Equation: } y = 2x + 3$$
$$\text{For 10 km: } y = 2(10) + 3 = \boxed{\$23}$$

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9. From Graph Points

Question: Find the equation of the line that passes through the points $(0, 4)$ and $(2, 0)$.

Solution:

$$m = \frac{0 - 4}{2 - 0} = -2$$
$$\text{Since } b = 4, \text{ equation is: } \boxed{y = -2x + 4}$$

10. Convert to Standard Form

Question: Convert $y = \frac{2}{3}x - 5$ into standard form.

Solution:

$$3y = 2x - 15 \Rightarrow \boxed{2x - 3y = 15}$$