M1 Training Problems

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1 Linear equations, sketches and exact plots

1. Solve $(4x-2)-(2x-1)=3x$. How many solutions does it have?

2. Solve $(3x-2)-(2x-1)=x$. How many solutions does it have?

3. Solve $(4x-1)-(2x-1)=2x$. How many solutions does it have?

4. Solve for x. $5x+6=3x+2$. How many solutions does it have?

5. Solve for x. $5x+2=5x+2$. How many solutions does it have?

6. Solve for x. $3x+1=3x-1$. How many solutions does it have?

7. Sketch freehand, no ruler: $y=x$, $y=-x$. Put them on the same axes. Remember to label everything.

8. Sketch freehand, no ruler: $y=2x$, $y=-2x$. Put them on the same axes.

9. Sketch freehand, no ruler.

$$y=\frac{x}{2}, \quad y=-\frac{x}{2}.$$

Put them on the same axes.

10. Sketch freehand, no ruler. Label everything.

$$y=2x+1.$$

11. Sketch freehand, no ruler. Label everything.

$$y=-2x-1.$$

12. Sketch freehand, no ruler. Label everything.

$$y=-\frac{x}{2}+3.$$

13. Sketch freehand, no ruler. Label everything.

$$y=\frac{x}{2}-3.$$

14. Make an exact plot. Find the x and y intercepts. Show your work. Use a ruler.

$$y = 3x - 2.$$

15. Make an exact plot.

$$y = -\frac{x}{3} + 1.$$

16. Consider $y = 3x - 2$.

(a) Make a freehand sketch, no ruler.
(b) Make an exact plot, with a ruler. Find intercepts.

17. Consider the equation

$$2x + 3 = -\frac{x}{2} + 1.$$

(a) Solve for x by algebra. How many solutions does it have?
(b) Make exact plots of the left-hand side and right-hand side of the equation. Show where the solutions are.

18. Consider the equation

$$2x + 3 = 2x - 1.$$

(a) Solve for x by algebra. How many solutions does it have?
(b) Make exact plots of the left-hand side and right-hand side of the equation. Show where the solutions are. Make sure your plots match your algebra.

19. Consider the equation

$$-2x + 1 = -2x + 1.$$

(a) Solve for x by algebra. How many solutions does it have?
(b) Make exact plots of the left-hand side and right-hand side of the equation. Show where the solutions are. Make sure your plots tell the same story as your algebra.

20. Consider the equation

$$3x - 6 = x = \frac{x}{3} + 2.$$

Does this equation have a solution? Make exact plots of the left-hand side, the right-hand side, and the middle, all on the same axes. Show where the solution is, if there is one.

21. Consider the equation

$$\frac{x}{2} + 1 = 2x - 3 = -x + 4.$$

Use exact plots of left-hand side, right-hand side and middle to figure out if this has solutions. Show where the solutions are, if there are any.

22. Consider the three-way equation

$$x + 5 = 2x + 6 = 3x + 7.$$

Make exact plots of the LHS, RHS and middle. Show where the solutions are, if any.

2 One equation, many unknowns

23. Give an example of how two lines can join to make a point. Draw.

24. Draw an example of two lines having no point in common.

25. Draw an example of two planes having no points in common.

26. Draw an example of two planes joining to make a line.

27. Draw an example of three planes joining to make a line.

28. Draw an example of three planes joining to make exactly one point.

29. Fill in this table.

Equations and unknowns	What can happen?
One equation, one unknown	No solutions. Anything is a solution. All solutions are on one point.
One equation, two unknowns. $ax + by = c$	
One equation, three unknowns. $ax + by + cz = d$	

30. Consider the equation $ax = b$. By choosing numbers for a and b you can give examples for the different cases.

(a) Give an example where it has no solution.
(b) Give an example where anything is a solution.
(c) Give an example where there is one solution on one point.

31. Consider $ax + by = c$. Choose numbers for a, b, c and give examples for the following different cases:

(a) Give an example where it has no solution.
(b) Give an example where anything is a solution.
(c) Give an example where all solutions are on a line.

32. Consider $ax + by = c$. Choose numbers for a, b, c and give examples for these different cases:

(a) Give an example where it has no solution.
(b) Give an example where anything is a solution.
(c) Give an example where all solutions are on a line.

33. Consider $ax + by + cz = d$. Choose numbers for a, b, c, d and give examples for these different cases:

(a) Give an example where it has no solution.
(b) Give an example where anything is a solution.
(c) Give an example where all solutions are on a plane.

34. Consider the line $ax + by = c$. Find the x-intercept. Show how you found it.

35. Consider the line $ax + by = c$. Find the y-intercept. Show how.

36. Consider the line $ax + by = c$. Find the slope. Don't just write the answer. Show how.

37. Consider the equation $2x + y = 1$. Make an exact plot of this by the *abc* method. Find the x-intercept and y-intercept. Use a ruler. Label everything: axes, line, intercepts.

38. Make an exact plot of

$$-\frac{x}{2} + y = 3.$$

by the *abc* method.

39. Make an exact plot of $2y - x = -2$ by the *abc* method. Be careful.

3 Two equations, two unknowns

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