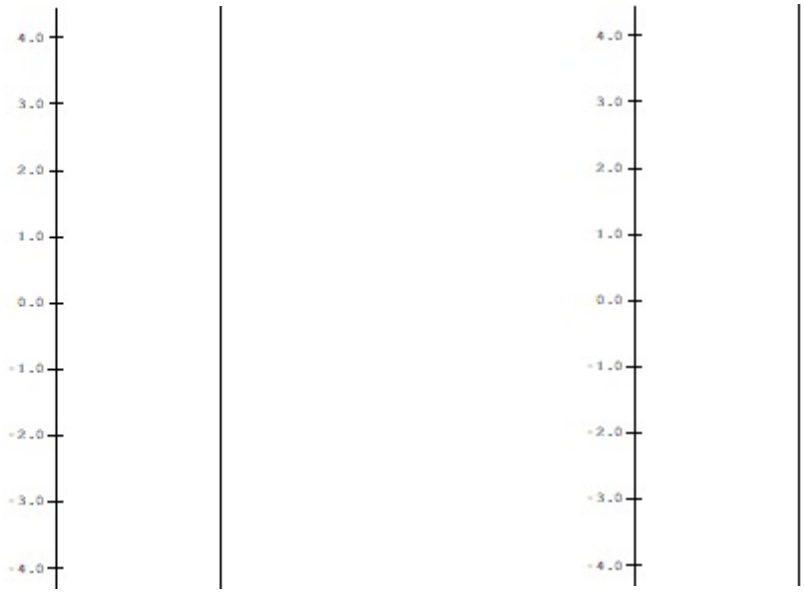
1.

a. Complete the following tables for $m(x) = 2x$ and $s(x) = x + 1$

| $x$ | $m(x) = 2x$ | $s(x) = x + 1$ |
|---|---|---|
| 2 | | |
| 1 | | |
| 0 | | |
| -1 | | |
| -2 | | |

b. Using the data from part a), on separate diagrams sketch mapping diagrams for $m(x) = 2x$ and $s(x) = x+1$



2. Let $q(x) = x^2$.

a. Complete the following table for $q(x) = x^2$.

| $x$ | $q(x) = x^2$ |
|---|---|
| 2 | |
| 1 | |
| 0 | |
| -1 | |
| -2 | |

b. Using the data from part a), sketch a mapping diagram for $q(x) = x^2$.

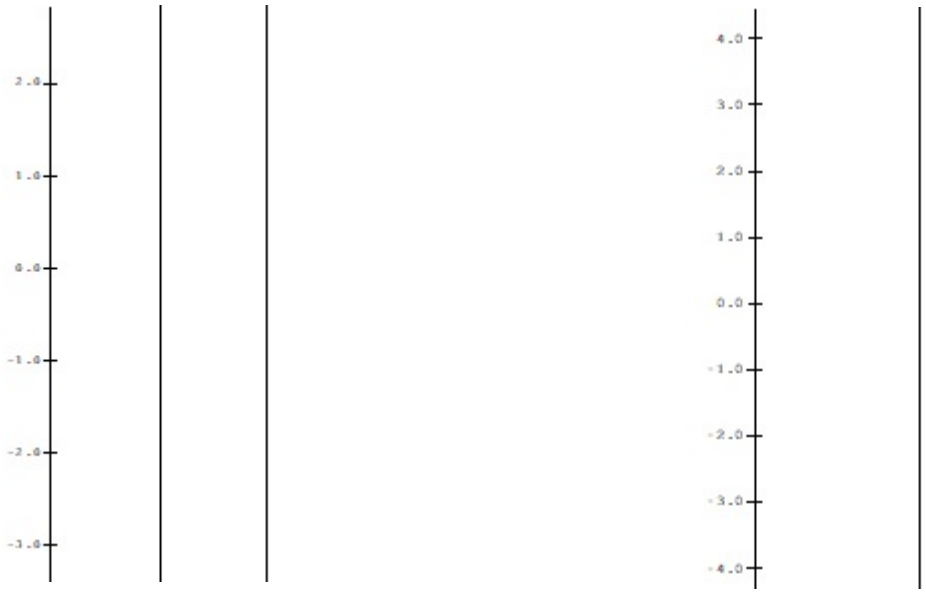
3.

a. Complete the following table for the composite function $f(x) = s(m(x)) = 2x + 1$.

| $x$ | $m(x) = 2x$ | $s(m(x)) = 2\,x + 1$ |
|---|---|---|
| 2 | | |
| 1 | | |
| 0 | | |
| -1 | | |
| -2 | | |

b. Use the table and the previous sketches of 1.b to draw a composite sketch of the mapping diagram with 3 axes for the composite function $f(x) = s(m(x)) = 2x + 1$

c. Draw a sketch for the mapping diagram with 2 axes of $f(x) = 2\,x + 1$.



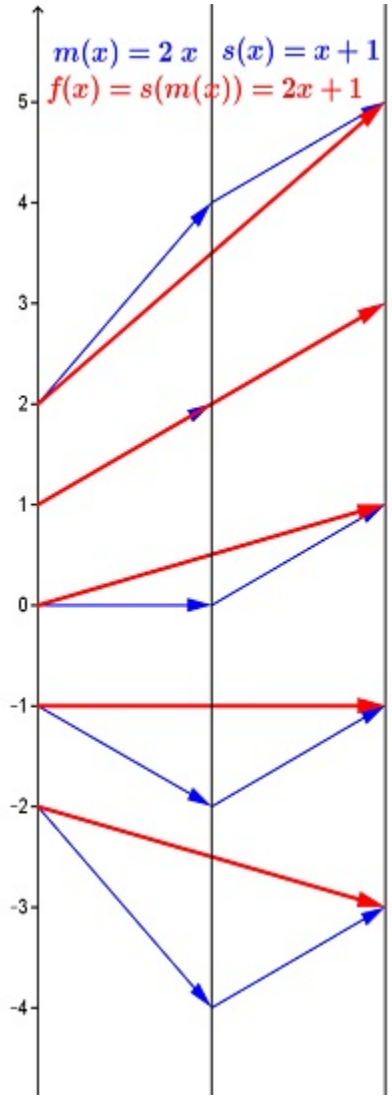
4. Solving Equations:
   a. Use a standard algebraic approach to solve the following equation. Show all steps. Check your answer.

$$2x + 1 = 5.$$

Work:

Check:

b. On the mapping diagram below indicate by adding and circling numbers and arrows how the diagram visualizes the work in your algebraic solution of $2x + 1 = 5$.



5. Solve $\mathbf{2(x-3)^2 + 1 = 9}$ with a mapping diagram.

**Understand the problem (Polya: Step 1)**: $\mathbf{2(x-3)^2 + 1}$ is a function of $x$.

$\boldsymbol{f(x) = 2(x-3)^2 + 1}$ Find any and all $x$ where $f(x) = 9$.

a. Express $\boldsymbol{f(x) = 2(x-3)^2 + 1}$ as composition of core functions.

$f(x) = h(m(q(z(x))))$ where

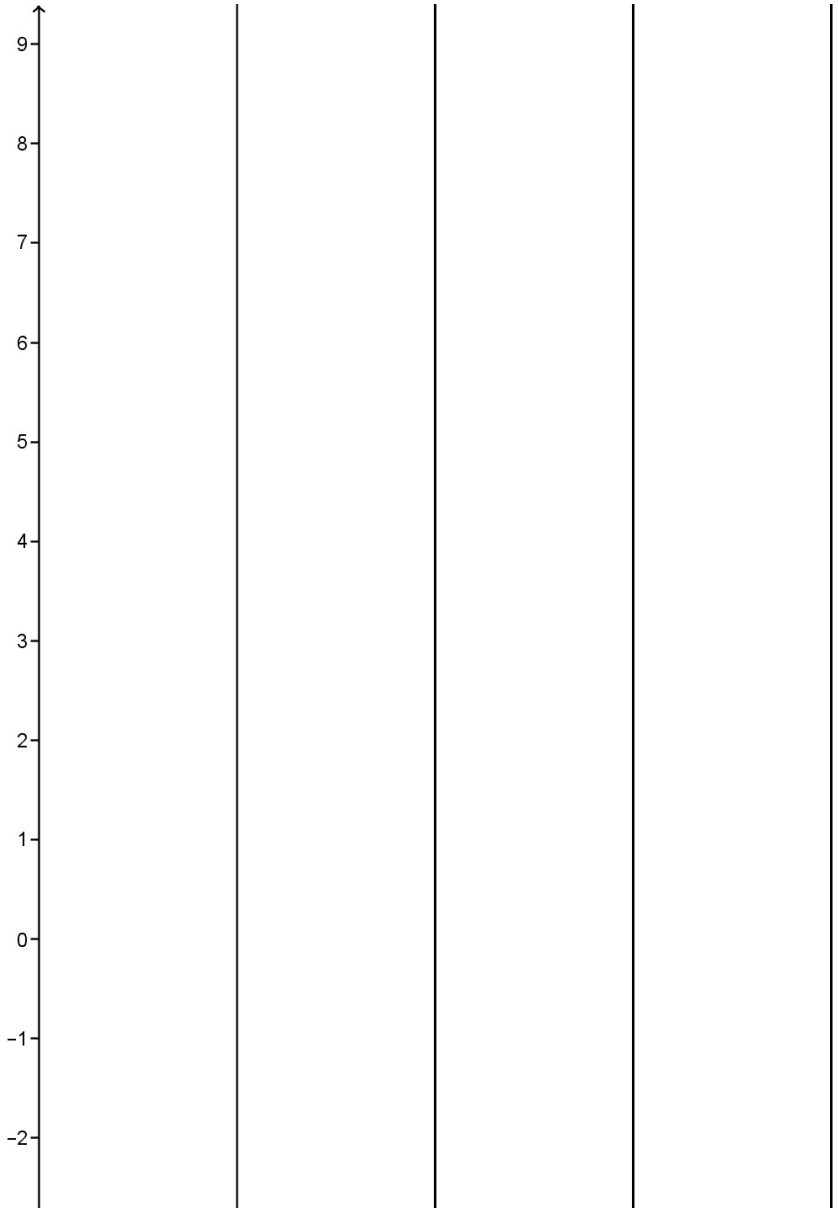
$h(x) =$ _____

$m(x) =$ _____

$q(x) =$ _____

$z(x) =$ _____

b. Sketch a mapping diagram for $f$ **as a composition**.



**Make a plan (Polya: step 2)**

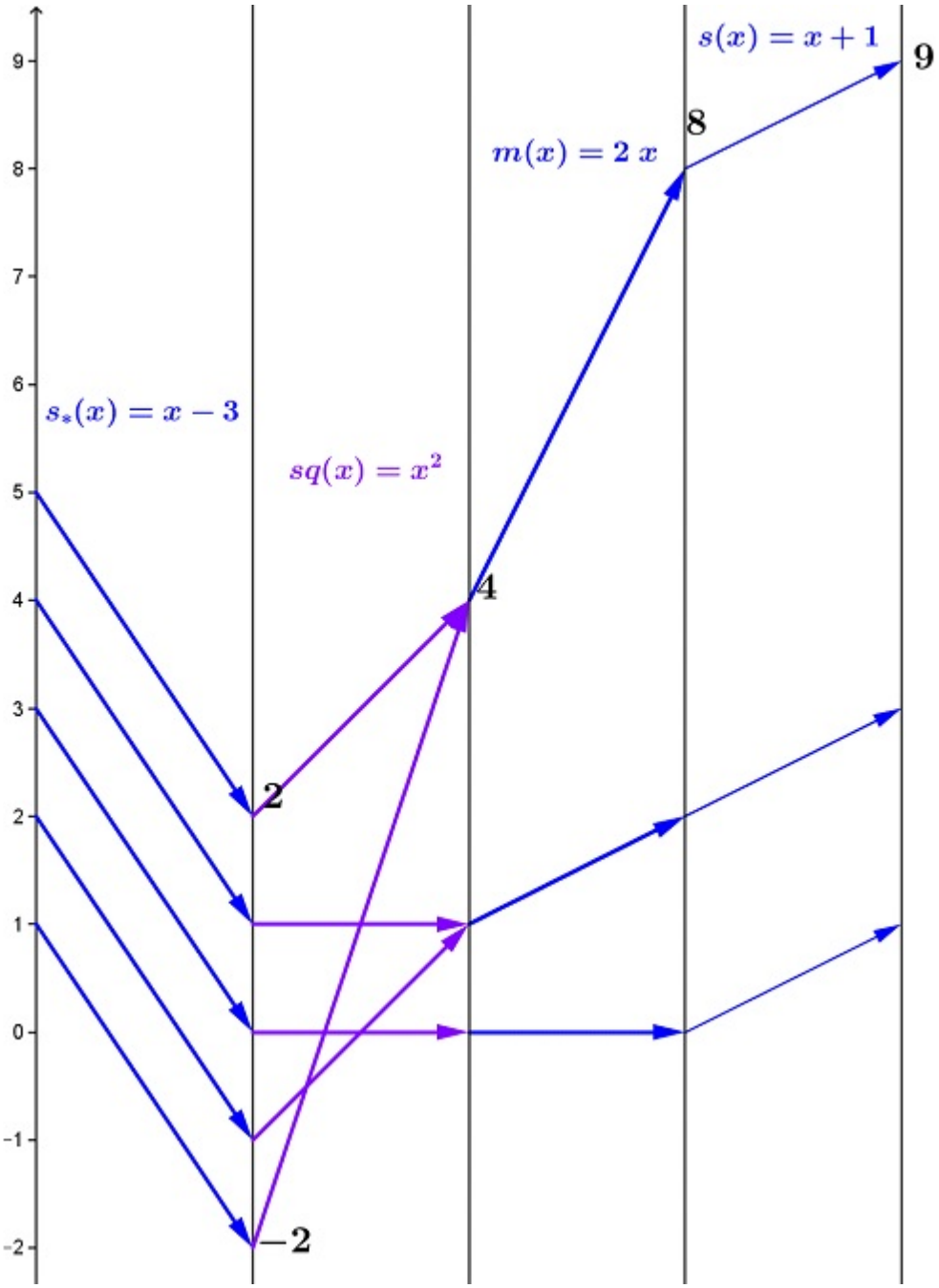
Undo $f(x) = 9$ by undoing each step of $f$: Undo $h(x) = x+1$;Undo $m(x) = 2x$ ;Undo $q(x) = x^2$
Undo $z(x) = x-3$

**Execute the plan (Polya: Step 3)**

*c.* On the mapping diagram below indicate by circling numbers and arrows how the diagram visualizes the solution of **$2(x-3)^2 + 1 = 9$.**

**d. Check the solutions.**

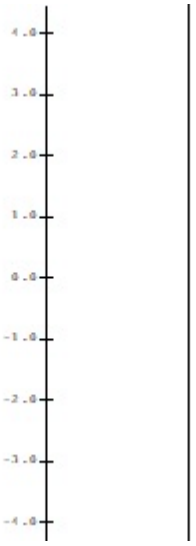
**Check :**



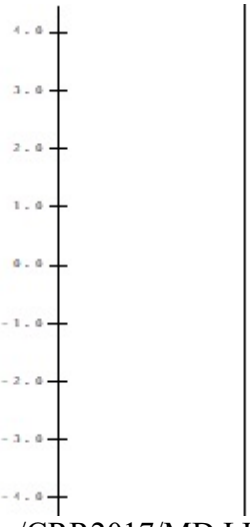
6. Let **f (x) = mx + b** sketch mapping diagrams for the following:
Use the same scale for the second axis.

a. m = -2; b = 1: $f(x) = -2x + 1$;


b. m = 2 b = 1: $f(x) = 2x + 1$



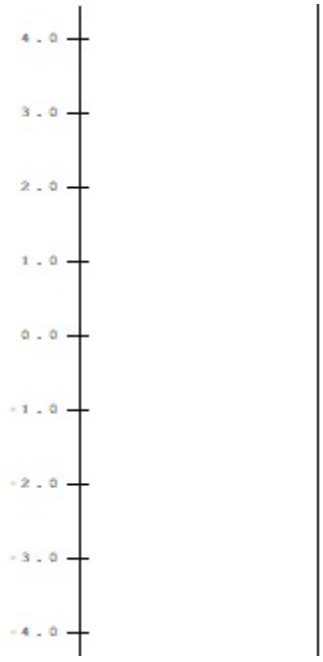

c. m = ½; b = 1: $f(x) = ½ x + 1$




d. m = 0; b = 1: $f(x) = 0 x + 1$


e. m = 1; b = 1: $f(x) = x + 1$

7. Suppose $f$ is a linear function with $f(1) = 3$ and $f(3) = -1$.
   a. Use a focus point to find $f(0)$.




   b. Use a focus point to find $x$ where $f(x) = 0$.

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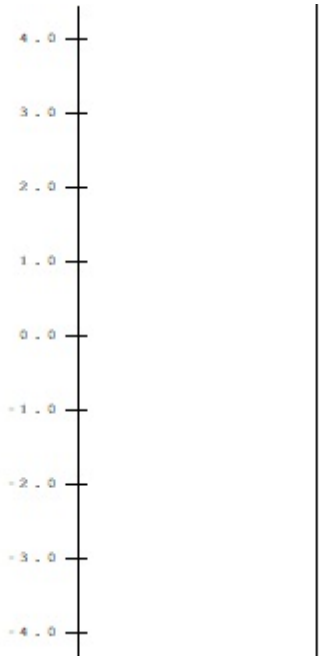
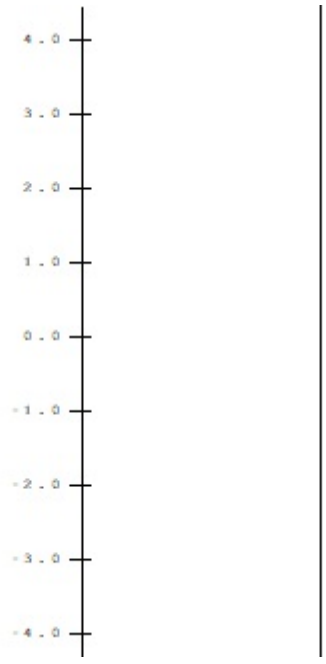
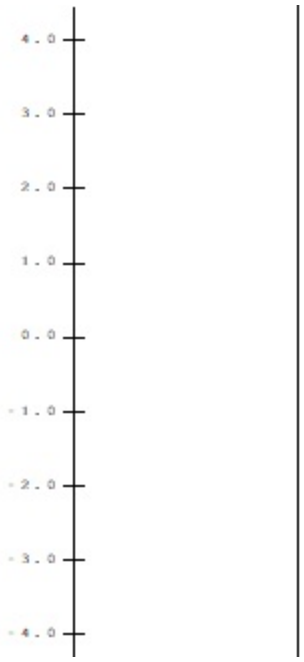
8. Suppose $f$ is a linear function with $f(x) = 2x - 1$.
   a. Sketch a mapping diagram for considering whether $\lim_{x \to 1} f(x) = 1.5$ with $\epsilon = ½$ and $\delta = 0.5$.




   b. Sketch a mapping diagram for considering whether $\lim_{x \to 1} f(x) = 1$ with $\epsilon = ½$ and $\delta = 0.25$.



9. Let $f(x) = x^2 - 1$. Visualize an estimation of the derivative $f'(1)$ as a focus point and derivative "vector" on a mapping diagram using $\Delta x = \pm 0.1$ .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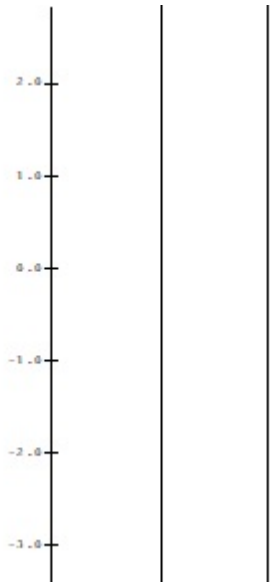
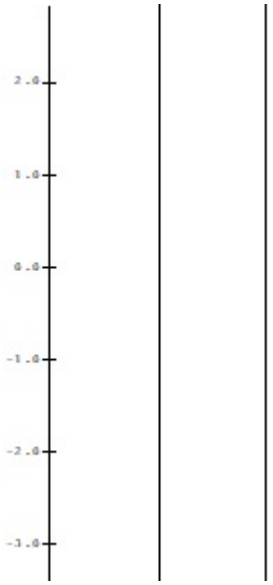
10. Let $f(x) = 2x$ and $g(x) = -3x + 1$. Visualize the composition of linear functions $f \circ g$ and $g \circ f$ using mapping diagrams.




$f \circ g$




$g \circ f$

11. Let $f(x) = x^2 - 1$. Use a mapping diagram to visualize estimating the values of $f(1.1)$ and $f(0.9)$ with the differential. [Use $dx = \pm 0.1$, near the value for $x = 1$ where $f(1) = 0$, and $dy = f'(1) * dx$.]


12. Complete the following table to estimate of the solution $f(2)$ of the following initial value problem by Euler's method with $n = 4$ ( $\Delta x = ½$) . Use a mapping diagram to visualize the result.

$\frac{dy}{dx} = f'(x) = 2x - 1$ with $f(0) = 1$.

| $x$ | $f(x)$ | $\frac{dy}{dx} = f'(x) = 2x - 1$ | $dy = f'(x)dx = (2x - 1)dx$ |
|---|---|---|---|
| 0 | 1 | | |
| 1/2 | | | |
| 1 | | | |
| 3/2 | | | |
| 2 | | | |