

# IM2 Book 1 Selected Answers

IM2 Dream Team

September 30, 2025

1.  $x = -3$

2.  $-$

3. (a)  $x(x + 4)$   
 (b)  $3x(x - 5)$   
 (c)  $-x(2x + 7)$

4. (a)  $x = 0, 4$   
 (b)  $x = 0, 5$   
 (c)  $x = 0, -\frac{7}{2}$

	$2 \leq x$	$-$	all values that are at least 2	$-$
5.	$-4 < x < 0$	$-$	$-$	$(-4, 0)$
	$x < 1$	$-$	all values that are less than 1	$(-\infty, 1)$

6. Answers may vary. Soln:  $(0, 5)$ . Non-soln:  $(0, 0)$ .

7.  $4a^2, 2a^2$

8. (a)  $-$   
 (b)  $24 \leq x$

9.  $(x + 4)(x + 1)$ . 4 and 1 add to 5 and multiply to 4.

10.  $x^2 + (q + p)x + pq$ .  $\nabla = (q + p)$ .  $\Delta = pq$ .

11. (a)  $-$   
 (b)  $37 \leq 37$   
 (c)  $-$   
 (d)  $x \geq 18$

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

13. (a) Answers may vary.  
 System soln:  $(2, 4)$   
 Soln to one eqn but not the other:  $(0, 0)$   
 Not a system soln:  $(0, 0)$

- (b) –  
 (c) One solution.

14. Answers may vary.

$$\begin{cases} y = x \\ y = x + 1 \end{cases}$$

15. Answers may vary.

$$\begin{cases} y = x \\ 2y = 2x \end{cases}$$

16.  $(3x)^2$

17.  $x > -5$

18. (a)  $x \leq -10$

(b)  $x \leq -10$

19. (a)  $x = -4$

(b)  $x = 3, 5$

(c)  $x = -1, 7$

20. (a)  $(\frac{1}{2}, \frac{1}{3})$

(b)  $(1, -2)$

21. (a) –

(b)  $y = x^2$

22. (a)  $f(2) = 5$

$f(-4) = -1$

(b)  $x = -1$

23. (a)  $2x + y = 3$

(b) No solutions

	Words	Function Formula
24.		$f(x) = 2x$
		$f(x) = 5x - 1$
	divide the input by 2 and add 5	

25. (a)  $f(-3) = 3$

$f(0) = 0$

$f(2) = 2$

(b)  $x = \pm 4$

26. (a)  $-$   
 (b)  $6$   
 (c)  $x = \pm 10$

27.  $(3x + 4)(x - 3)$

28. (a)  $-7 \leq x$   
 (b)  $x < 4$

29. (a)  $5$   
 (b)  $12$   
 (c)  $|x - y|$

30. No

31.  $x \geq 0$

32.  $|a - b| = |b - a|$

33.  $(4x + 1)(x + 5)$

34. (a)  $9$  and  $4$   
 (b)  $9$  and  $-4$   
 (c)  $x$  and  $7$   
 (d)  $x$  and  $0$

35. (a)  $-$   
 (b)  $|x| > 6$   
 (c)  $-$

	$-$	all values that are 2 units away from $-5$	$-$	$x = -3, -7$
36.	$ x  = 5$	$-$	$-$	$x = -5, 5$
	$ x + 1  = 2$	all values that are 2 units away from $-1$	$-$	$x = -3, 1$

37. (a) All values that are 5 units away from  $2$ .  
 (b) All values that are 10 units away from  $-4$ .

38.  $A = (2a + b)(a + 3b)$

39. (a)  $(x - 2)(x - 6)$   
 (b)  $(3x - 2)(2x + 3)$   
 (c)  $2x(3x - 1)$

40.  $BC = 8$ ,  $AC = 15$ , and  $AB = 17$

41. (a)  $x^2 - 16$   
 (b)  $x^2 - 49$

(c)  $9x^2 - 4$

(d)  $x^2 - a^2$

42. (a)  $(x - 8)(x + 8)$

(b)  $(x - c)(x + c)$

(c)  $(2x - 5)(2x + 5)$

(d)  $(ax - c)(ax + c)$

43.	–	all values that are at most 2 units away from -5	–	$-7 \leq x \leq -3$
	$ x  \geq 6$	–	–	$x < -6$ or $x > 6$
	$ x - 1  \leq 4$	all values that are at most 4 units away from 1	–	–

44. (a) –

(b)  $(0, 0)$

(c)  $(-\infty, \infty)$

(d)  $y = 0$

(e)  $[0, \infty)$

45.  $y = -x, y = x$

$$|x| = \begin{cases} -x & \text{if } x < 0 \\ x & \text{if } x \geq 0 \end{cases}$$

46.  $x = 12$

47. (a) All values at most 2 units away from 7.

(b)  $x > -2$  or  $x < -8$

48.  $(-2, 2)$

$(3, 7)$

49. (a) –

(b)  $|x - 52| \leq 3$

50.  $|x - y| = 12$ . Infinite.

51. (a)  $3x(x + 4)$

(b)  $(x + 5)(x + 3)$

(c)  $2(x + 1)(x - 3)$

(d)  $9(x - 2)(x + 2)$

52. 120

53.

$$|x + 2| = \begin{cases} -x + 2 & \text{if } x < -2 \\ x + 2 & \text{if } x \geq -2 \end{cases}$$

54. (a)  $x = -5, 5$   
 (b)  $\text{blob} = -5, 5$
55. Yes
56.  $f(x) = |x|$
57. (a) 77 blocks  
 (b) 19 blocks  
 (c) –  
 (d)  $y = |x - 91|$
58. –
59.  $|l - 12| \leq 0.01$
60. (a)  $(-28, 12)$   
 (b)  $(-\infty, 0] \cup [8, \infty)$
61. (a)  $a = -1, -6$   
 (b)  $x = \frac{-19}{2}, \frac{9}{2}$
62.  $-1 \leq a \leq 6$
63.  $|x| = 3$   
 $x = -3$  or  $x = 3$
64. No
65. (a) –  
 (b)  $y = |x - 34|$   
 (c)  $x = 18, 50$
66.  $x = -4, 4$
67. (a) –  
 (b) vertex:  $(4, 0)$   
 domain:  $(-\infty, \infty)$   
 range:  $[0, \infty)$   
 minimum value:  $y = 0$   
 (c)  $x = 4$
68. (a) Shift  $f(x)$  left by 5  
 (b)  $(-5, 0)$ . Shift it left by 5.
69.  $x = 6, 1$

70.

$$|x - 7| = \begin{cases} x - 7 & \text{if } x \geq 7 \\ -x + 7 & \text{if } x < 7 \end{cases}$$

71.  $(10, 3)$

72.  $x = 4, -6$

73.  $x = -1, -4$

74. Shift it right by 3

75.  $g(x) = |x - h|$

$x$	$ x $	$ x  - 2$
-3	3	1
-2	2	0
-1	1	-1
0	0	-2
1	1	-1
2	2	0
3	3	1

Translate  $f(x)$  down by 2.

77. (a)  $(-\frac{4}{3}, \frac{4}{3})$

(b)  $(-\infty, -\frac{84}{5}] \cup [\frac{56}{5}, \infty)$

(c)  $[-\frac{1}{2}, \frac{13}{2}]$

78. (a)  $x = -5, -4$

(b)  $x = -\frac{7}{2}, 3$

(c)  $x = -9, 9$

(d)  $x = -\frac{1}{4}, 4$

79. Left graph:  $y = |x|$

Right graph:  $y = |x - 3|$

80. Shift/translate the graph up by 3

Shift/translate the graph down by 5.

81.  $f(x) = |x - 3|$

82.  $n^2$

83.  $x = -2, 4$

$x \in [-2, 4]$

84. (a) Shift/translate the graph up by  $k$

- (b)  $(0, k)$   
Shift/translate  $(0, 0)$  up by  $k$

85.

$x$	$ x $	$- x $
-3	3	-3
-2	2	-2
-1	1	-1
0	0	0
1	1	-1
2	2	-2
3	3	-3

You can reflect  $y = |x|$  over the  $x$ -axis.

86.  $(2, 0); (-2, 0), (2, 0)$

87.

$$g(x) = \begin{cases} -x - 2 & \text{if } x \leq 0 \\ x - 2 & \text{if } x > 0 \end{cases}$$

88. Shift  $f(x)$  to the right  $h$  and up  $k$ . Vertex:  $(h, k)$ .

89.

$x$	$ x $	$2 x $	$0.5 x $
-3	3	6	1.5
-2	2	4	1
-1	1	2	0.5
0	0	0	0
1	1	2	0.5
2	2	4	1
3	3	6	1.5

You can vertically stretch  $|x|$  by a factor of 2 to get  $2|x|$ . You can vertically compress  $|x|$  by a factor of 2 to get  $0.5|x|$ .

90. (a) Vertically stretch  $|x|$  by a factor of  $a$ .  
(b) Vertically stretch  $|x|$  by a factor of  $a$  and then reflect it over the  $x$ -axis.

91. 320, 210

92.  $\begin{bmatrix} 320 & 98 & 135 \\ 405 & 110 & 120 \end{bmatrix}$

93.  $(0, |h| + k)$

94. Vertex:  $(0, 0)$   
Vertex:  $(0, 6)$ .  $x$ -intercepts:  $(-2, 0), (2, 0)$

95. (a) Shift  $|x|$  right by 1. Vertically stretch it by a factor of 2. Shift it down by 6.

- (b) –  
 (c) Vertex:  $(1, -6)$   
 Domain:  $(-\infty, \infty)$   
 Range:  $[-6, \infty)$   
 Minimum-value:  $y = -6$   
 (d)  $(-2, 0), (4, 0)$

96. (a) Shift  $f(x)$  right by 3. Reflect it over the x-axis. Shift it up by 5.  
 (b) –  
 (c) Vertex:  $(3, 5)$   
 Domain:  $(-\infty, \infty)$   
 Range:  $(-\infty, 5]$   
 Maximum value: 5  
 (d)  $(-2, 0), (8, 0)$

97.  $a = -3$

98.

$x$	$ x $	$x^2$
-2	2	4
-1	1	1
$-\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{4}$
1	1	1
2	2	4

Vertex:  $(0, 0)$   
 Domain:  $(-\infty, \infty)$   
 Range:  $[0, \infty)$   
 Minimum value: 0  
 Axis of symmetry:  $x = 0$

99. (a)  $y = |x - 1| + 2$   
 (b)  $y = -|x| + 1$   
 (c)  $y = 2|x + 3| - 1$

100.  $A + B = \begin{bmatrix} -1 & 3 \\ 6 & -2 \end{bmatrix} + \begin{bmatrix} 7 & 0 \\ 2 & -4 \end{bmatrix} = \begin{bmatrix} 6 & 3 \\ 8 & -6 \end{bmatrix}$   
 $A - B = \begin{bmatrix} -1 & 3 \\ 6 & -2 \end{bmatrix} - \begin{bmatrix} 7 & 0 \\ 2 & -4 \end{bmatrix} = \begin{bmatrix} -8 & 3 \\ 4 & 2 \end{bmatrix}$