SOLVING EQUATIONS

A DEFINITIONS

A.1 MATH ESCAPE ROOM LEVEL 1

MCQ 1: For this Math escape room, the code is:

$$\bigcirc + 5 = 9$$

Which code do you use to enter?

- ☐ $\bigcirc = 2$
- ☒ $\bigcirc = 4$
- ☐ $\bigcirc = 5$
- ☐ $\bigcirc = 9$

Answer:

- For $\bigcirc = 2$:
$$(2) + 5 = 9$$
$$7 = 9 \quad \text{(False)}$$
- For $\bigcirc = 4$:
$$(4) + 5 = 9$$
$$9 = 9 \quad \text{(True)}$$
- For $\bigcirc = 5$:
$$(5) + 5 = 9$$
$$10 = 9 \quad \text{(False)}$$
- For $\bigcirc = 9$:
$$(9) + 5 = 9$$
$$14 = 9 \quad \text{(False)}$$

Therefore, the correct code to enter is $\bigcirc = 4$.

MCQ 2: For this Math escape room, the code is:

$$\triangle + 10 = 1 + 2 \times 6$$

Which code do you use to enter?

- ☒ $\triangle = 3$
- ☐ $\triangle = 5$
- ☐ $\triangle = 8$
- ☐ $\triangle = 10$

Answer:

- For $\triangle = 3$:
$$(3) + 10 = 1 + 2 \times 6$$
$$13 = 1 + 12$$
$$13 = 13 \quad \text{(True)}$$
- For $\triangle = 5$:
$$(5) + 10 = 1 + 2 \times 6$$
$$15 = 1 + 12$$
$$15 = 13 \quad \text{(False)}$$
- For $\triangle = 8$:
$$(8) + 10 = 1 + 2 \times 6$$
$$18 = 1 + 12$$
$$18 = 13 \quad \text{(False)}$$
- For $\triangle = 10$:
$$(10) + 10 = 1 + 2 \times 6$$
$$20 = 1 + 12$$
$$20 = 13 \quad \text{(False)}$$

Therefore, the correct code to enter is $\triangle = 3$.

MCQ 3: For this Math escape room, the code is:

$$\square + 5 = 2 \times 4 + 1$$

Which code do you use to enter?

- ☐ $\square = 6$
- ☐ $\square = 8$
- ☐ $\square = 5$
- ☒ $\square = 4$

Answer:

- For $\square = 6$:
$$(6) + 5 = 2 \times 4 + 1$$
$$11 = 8 + 1$$
$$11 = 9 \quad \text{(False)}$$
- For $\square = 8$:
$$(8) + 5 = 2 \times 4 + 1$$
$$13 = 8 + 1$$
$$13 = 9 \quad \text{(False)}$$
- For $\square = 5$:
$$(5) + 5 = 2 \times 4 + 1$$
$$10 = 8 + 1$$
$$10 = 9 \quad \text{(False)}$$
- For $\square = 4$:
$$(4) + 5 = 2 \times 4 + 1$$
$$9 = 8 + 1$$
$$9 = 9 \quad \text{(True)}$$

Therefore, the correct code to enter is $\square = 4$.

MCQ 4: For this Math escape room, the code is:

$$\bigcirc - 4 = 3 \times 2 - 1$$

Which code do you use to enter?

- ☐ $\bigcirc = 7$
- ☐ $\bigcirc = 6$

☐ $\bigcirc = 5$

☒ $\bigcirc = 9$

Answer:

- For $\bigcirc = 7$:

$$\begin{aligned} (7) - 4 &= 3 \times 2 - 1 \\ 3 &= 6 - 1 \\ 3 &= 5 \qquad \text{(False)} \end{aligned}$$

- For $\bigcirc = 6$:

$$\begin{aligned} (6) - 4 &= 3 \times 2 - 1 \\ 2 &= 6 - 1 \\ 2 &= 5 \qquad \text{(False)} \end{aligned}$$

- For $\bigcirc = 5$:

$$\begin{aligned} (5) - 4 &= 3 \times 2 - 1 \\ 1 &= 6 - 1 \\ 1 &= 5 \qquad \text{(False)} \end{aligned}$$

- For $\bigcirc = 9$:

$$\begin{aligned} (9) - 4 &= 3 \times 2 - 1 \\ 5 &= 6 - 1 \\ 5 &= 5 \qquad \text{(True)} \end{aligned}$$

Therefore, the correct code to enter is $\bigcirc = 9$.

A.2 MATH ESCAPE ROOM LEVEL 2

MCQ 5: For this Math escape room, the code is:

$$2 \times \bigcirc - 2 = \bigcirc + 10$$

Which code do you use to enter?

☐ $\bigcirc = 8$

☐ $\bigcirc = 10$

☒ $\bigcirc = 12$

☐ $\bigcirc = 14$

Answer:

- For $\bigcirc = 8$:

$$\begin{aligned} 2 \times (8) - 2 &= (8) + 10 \\ 16 - 2 &= 8 + 10 \\ 14 &= 18 \qquad \text{(False)} \end{aligned}$$

- For $\bigcirc = 10$:

$$\begin{aligned} 2 \times (10) - 2 &= (10) + 10 \\ 20 - 2 &= 10 + 10 \\ 18 &= 20 \qquad \text{(False)} \end{aligned}$$

- For $\bigcirc = 12$:

$$\begin{aligned} 2 \times (12) - 2 &= (12) + 10 \\ 24 - 2 &= 12 + 10 \\ 22 &= 22 \qquad \text{(True)} \end{aligned}$$

- For $\bigcirc = 14$:

$$\begin{aligned} 2 \times (14) - 2 &= (14) + 10 \\ 28 - 2 &= 14 + 10 \\ 26 &= 24 \qquad \text{(False)} \end{aligned}$$

Therefore, the correct code to enter is $\bigcirc = 12$.

MCQ 6: For this Math escape room, the code is:

$$3x + 7 = x + 19$$

Which code do you use to enter?

☐ $x = 2$

☐ $x = 4$

☒ $x = 6$

☐ $x = 8$

Answer:

- For $x = 2$:

$$\begin{aligned} 3 \times (2) + 7 &= (2) + 19 \\ 6 + 7 &= 2 + 19 \\ 13 &= 21 \qquad \text{(False)} \end{aligned}$$

- For $x = 4$:

$$\begin{aligned} 3 \times (4) + 7 &= (4) + 19 \\ 12 + 7 &= 4 + 19 \\ 19 &= 23 \qquad \text{(False)} \end{aligned}$$

- For $x = 6$:

$$\begin{aligned} 3 \times (6) + 7 &= (6) + 19 \\ 18 + 7 &= 6 + 19 \\ 25 &= 25 \qquad \text{(True)} \end{aligned}$$

- For $x = 8$:

$$\begin{aligned} 3 \times (8) + 7 &= (8) + 19 \\ 24 + 7 &= 8 + 19 \\ 31 &= 27 \qquad \text{(False)} \end{aligned}$$

Therefore, the correct code to enter is $x = 6$.

MCQ 7: For this Math escape room, the code is:

$$2x - 2 = x + 10$$

Which code do you use to enter?

☐ $x = 6$

☐ $x = 8$

☐ $x = 10$

☒ $x = 12$

Answer:

- For $x = 6$:

$$\begin{aligned} 2 \times (6) - 2 &= (6) + 10 \\ 12 - 2 &= 6 + 10 \\ 10 &= 16 \qquad \text{(False)} \end{aligned}$$

- For $x = 8$:

$$\begin{aligned} 2 \times (8) - 2 &= (8) + 10 \\ 16 - 2 &= 8 + 10 \\ 14 &= 18 \qquad \text{(False)} \end{aligned}$$

- For $x = 10$:

$$\begin{aligned} 2 \times (10) - 2 &= (10) + 10 \\ 20 - 2 &= 10 + 10 \\ 18 &= 20 \qquad \text{(False)} \end{aligned}$$

- For $x = 12$:

$$\begin{aligned} 2 \times (12) - 2 &= (12) + 10 \\ 24 - 2 &= 12 + 10 \\ 22 &= 22 \qquad \text{(True)} \end{aligned}$$

Therefore, the correct code to enter is $x = 12$.

MCQ 8: For this Math escape room, the code is:

$$x \times (x - 2) = 24$$

Which code do you use to enter?

☒ $x = 6$

☐ $x = 7$

☐ $x = 8$

☐ $x = 9$

Answer:

- For $x = 6$:

$$\begin{aligned} (6) \times ((6) - 2) &= 24 \\ 6 \times 4 &= 24 \\ 24 &= 24 \quad \text{(True)} \end{aligned}$$

- For $x = 7$:

$$\begin{aligned} (7) \times ((7) - 2) &= 24 \\ 7 \times 5 &= 24 \\ 35 &= 24 \quad \text{(False)} \end{aligned}$$

- For $x = 8$:

$$\begin{aligned} (8) \times ((8) - 2) &= 24 \\ 8 \times 6 &= 24 \\ 48 &= 24 \quad \text{(False)} \end{aligned}$$

- For $x = 9$:

$$\begin{aligned} (9) \times ((9) - 2) &= 24 \\ 9 \times 7 &= 24 \\ 63 &= 24 \quad \text{(False)} \end{aligned}$$

Therefore, the correct code to enter is $x = 6$.

A.3 MATH ESCAPE ROOM LEVEL 3

MCQ 9: For this Math escape room, the code is:

$$x^2 - 4 = 0$$

Which code do you use to enter?

☒ $x = 2$

☐ $x = 3$

☐ $x = 4$

☐ $x = 5$

Answer:

- For $x = 2$:

$$\begin{aligned} (2)^2 - 4 &= 0 \\ 4 - 4 &= 0 \\ 0 &= 0 \quad \text{(True)} \end{aligned}$$

- For $x = 3$:

$$\begin{aligned} (3)^2 - 4 &= 0 \\ 9 - 4 &= 0 \\ 5 &= 0 \quad \text{(False)} \end{aligned}$$

- For $x = 4$:

$$\begin{aligned} (4)^2 - 4 &= 0 \\ 16 - 4 &= 0 \\ 12 &= 0 \quad \text{(False)} \end{aligned}$$

- For $x = 5$:

$$\begin{aligned} (5)^2 - 4 &= 0 \\ 25 - 4 &= 0 \\ 21 &= 0 \quad \text{(False)} \end{aligned}$$

Therefore, the correct code to enter is $x = 2$.

MCQ 10: For this Math escape room, the code is:

$$x^2 - 2x + 1 = 0$$

Which code do you use to enter?

☒ $x = 0$

☐ $x = 1$

☐ $x = 2$

☐ $x = 3$

Answer:

- For $x = 0$:

$$\begin{aligned} (0)^2 - 2 \times (0) + 1 &= 0 \\ 0 - 0 + 1 &= 0 \\ 1 &= 0 \quad \text{(False)} \end{aligned}$$

- For $x = 1$:

$$\begin{aligned} (1)^2 - 2 \times (1) + 1 &= 0 \\ 1 - 2 + 1 &= 0 \\ 0 &= 0 \quad \text{(True)} \end{aligned}$$

- For $x = 2$:

$$(2)^2 - 2 \times (2) + 1 = 0$$
$$4 - 4 + 1 = 0$$
$$1 = 0 \quad \text{(False)}$$

- For $x = 3$:

$$(3)^2 - 2 \times (3) + 1 = 0$$
$$9 - 6 + 1 = 0$$
$$4 = 0 \quad \text{(False)}$$

Therefore, the correct code to enter is $x = 1$.

MCQ 11: For this Math escape room, the code is:

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

Which code do you use to enter?

☐ $x = 2$

☐ $x = 3$

☒ $x = 4$

☐ $x = 5$

Answer:

- For $x = 2$:

$$\frac{2 \times (2) + 1}{(2) - 1} = 3$$
$$\frac{4+1}{2-1} = 3$$
$$\frac{5}{1} = 3$$
$$5 = 3 \quad \text{(False)}$$

- For $x = 3$:

$$\frac{2 \times (3) + 1}{(3) - 1} = 3$$
$$\frac{6+1}{3-1} = 3$$
$$\frac{7}{2} = 3$$
$$3.5 = 3 \quad \text{(False)}$$

- For $x = 4$:

$$\frac{2 \times (4) + 1}{(4) - 1} = 3$$
$$\frac{8+1}{4-1} = 3$$
$$\frac{9}{3} = 3$$
$$3 = 3 \quad \text{(True)}$$

- For $x = 5$:

$$\frac{2 \times (5) + 1}{(5) - 1} = 3$$
$$\frac{10+1}{5-1} = 3$$
$$\frac{11}{4} = 3$$
$$2.75 = 3 \quad \text{(False)}$$

Therefore, the correct code to enter is $x = 4$.

B SOLVING BY TRIAL AND ERROR

B.1 FINDING A SOLUTION LEVEL 1

Ex 12: Consider the equation $2x + 3 = 11$.
Use the trial-and-error method to find a solution (try $x = 2, 3, \ldots$).

$$x = \boxed{4}$$

Answer:

- Try $x = 2$:

$$2 \times (2) + 3 = 11$$
$$4 + 3 = 11$$
$$7 = 11 \quad \text{(False)}$$

- Try $x = 3$:

$$2 \times (3) + 3 = 11$$
$$6 + 3 = 11$$
$$9 = 11 \quad \text{(False)}$$

- Try $x = 4$:

$$2 \times (4) + 3 = 11$$
$$8 + 3 = 11$$
$$11 = 11 \quad \text{(True)}$$

Therefore, a solution to the equation $2x + 3 = 11$ is $x = 4$.

Ex 13: Consider the equation $3x - 5 = 10$.
Use the trial-and-error method to find a solution (try $x = 4, 5, \ldots$).

$$x = \boxed{5}$$

Answer:

- Try $x = 4$:

$$3 \times (4) - 5 = 10$$
$$12 - 5 = 10$$
$$7 = 10 \quad \text{(False)}$$

- Try $x = 5$:

$$3 \times (5) - 5 = 10$$
$$15 - 5 = 10$$
$$10 = 10 \quad \text{(True)}$$

Therefore, a solution to the equation $3x - 5 = 10$ is $x = 5$.

Ex 14: Consider the equation $x(x - 1) = 6$.
Use the trial-and-error method to find a solution (try $x = 2, 3, \ldots$).

$$x = \boxed{3}$$

Answer:

- Try $x = 2$:

$$(2) \times ((2) - 1) = 6$$
$$2 \times 1 = 6$$
$$2 = 6 \quad \text{(False)}$$

- Try $x = 3$:

$$\begin{aligned}(3) \times ((3) - 1) &= 6\\ 3 \times 2 &= 6\\ 6 &= 6 \quad \text{(True)}\end{aligned}$$

Therefore, a solution to the equation $x(x-1) = 6$ is $x = 3$.

Ex 15: Consider the equation $2x - 3 = 5x - 9$.
Use the trial-and-error method to find a solution (try $x = 0, 1, \ldots$).

$$x = \boxed{2}$$

Answer:

- Try $x = 0$:

$$\begin{aligned}2 \times (0) - 3 &= 5 \times (0) - 9\\ 0 - 3 &= 0 - 9\\ -3 &= -9 \quad \text{(False)}\end{aligned}$$

- Try $x = 1$:

$$\begin{aligned}2 \times (1) - 3 &= 5 \times (1) - 9\\ 2 - 3 &= 5 - 9\\ -1 &= -4 \quad \text{(False)}\end{aligned}$$

- Try $x = 2$:

$$\begin{aligned}2 \times (2) - 3 &= 5 \times (2) - 9\\ 4 - 3 &= 10 - 9\\ 1 &= 1 \quad \text{(True)}\end{aligned}$$

Therefore, a solution to the equation $2x - 3 = 5x - 9$ is $x = 2$.

B.2 FINDING A SOLUTION LEVEL 2

Ex 16: Consider the equation $x^2 - 2x + 1 = 0$.
Use the trial-and-error method to find a solution (try $x = 0, 1, \ldots$).

$$x = \boxed{1}$$

Answer:

- Try $x = 0$:

$$\begin{aligned}(0)^2 - 2 \times (0) + 1 &= 0\\ 0 - 0 + 1 &= 0\\ 1 &= 0 \quad \text{(False)}\end{aligned}$$

- Try $x = 1$:

$$\begin{aligned}(1)^2 - 2 \times (1) + 1 &= 0\\ 1 - 2 + 1 &= 0\\ 0 &= 0 \quad \text{(True)}\end{aligned}$$

Therefore, a solution to the equation $x^2 - 2x + 1 = 0$ is $x = 1$.

Ex 17: Consider the equation $x^2 - 9 = 0$.
Use the trial-and-error method to find a solution (try $x = 2, 3, \ldots$).

$$x = \boxed{3}$$

Answer:

- Try $x = 2$:

$$\begin{aligned}(2)^2 - 9 &= 0\\ 4 - 9 &= 0\\ -5 &= 0 \quad \text{(False)}\end{aligned}$$

- Try $x = 3$:

$$\begin{aligned}(3)^2 - 9 &= 0\\ 9 - 9 &= 0\\ 0 &= 0 \quad \text{(True)}\end{aligned}$$

Therefore, a solution to the equation $x^2 - 9 = 0$ is $x = 3$.

Ex 18: Consider the equation $\dfrac{x+2}{x-2} = 2$.
Use the trial-and-error method to find a solution (try $x = 6, 3, 4$).

$$x = \boxed{6}$$

Answer:

- Try $x = 6$:

$$\begin{aligned}\frac{6+2}{6-2} &= 2\\ \frac{8}{4} &= 2\\ 2 &= 2 \quad \text{(True)}\end{aligned}$$

- Try $x = 3$:

$$\begin{aligned}\frac{3+2}{3-2} &= 2\\ \frac{5}{1} &= 2\\ 5 &= 2 \quad \text{(False)}\end{aligned}$$

- Try $x = 4$:

$$\begin{aligned}\frac{4+2}{4-2} &= 2\\ \frac{6}{2} &= 2\\ 3 &= 2 \quad \text{(False)}\end{aligned}$$

Therefore, a solution to the equation $\frac{x+2}{x-2} = 2$ is $x = 6$.