Understanding Binomial Multiplication Using Integers Practice

A math student was asked to multiply $(4x + 1)(3x + 5)$. The work for their box model is shown below.

	4x	+ 1
3x	12x	3x
+ 5	20x	5

Unfortunately there is an error.
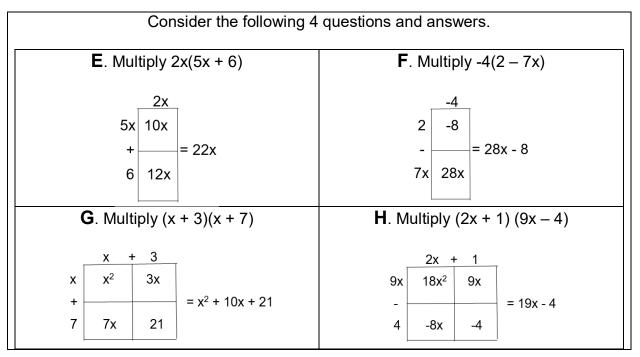
1. The correct statement is

   A) Within the box, the incorrect term is (20x) and the final answer should be $12x^2 + 23x + 5$.
   B) Within the box, the incorrect term is (12x) and the final answer should be $12x^2 + 23x + 5$.
   C) Within the box, the incorrect term is (20x) and the final answer should be $35x + 5$.
   D) Within the box, the incorrect term is (12x) and the final answer should be $35x + 5$.

2. The product of $(y + 7)(3y - 1)$ can be written in the form $ay^2 + by - c$, where a, b, and c are integers. The value of b is _____.

Use the following information to answer the next question.

Harley knows that $(6 - 2)(9 + 1)$ must be equal to 40, since $(4)(10) = 40$. But there is a problem when he tries to show it visually with a box.

	6	- 2	
9	54	-18	
+ 1	6	2	= 44

3. Explain the error that Harley made.

Consider the following 4 questions and answers.

E. Multiply 2x(5x + 6)

$$
\begin{array}{c|c}
 & 2x \\
\hline
5x & 10x \\
+ & \\
6 & 12x
\end{array} = 22x
$$

F. Multiply -4(2 – 7x)

$$
\begin{array}{c|c}
 & -4 \\
\hline
2 & -8 \\
- & \\
7x & 28x
\end{array} = 28x - 8
$$

G. Multiply (x + 3)(x + 7)

$$
\begin{array}{c|c|c}
 & x & + \; 3 \\
\hline
x & x^2 & 3x \\
+ & & \\
7 & 7x & 21
\end{array} = x^2 + 10x + 21
$$

H. Multiply (2x + 1) (9x – 4)

$$
\begin{array}{c|c|c}
 & 2x & + \; 1 \\
\hline
9x & 18x^2 & 9x \\
- & & \\
4 & -8x & -4
\end{array} = 19x - 4
$$

4. The two correct answers are

A) F and G   B) F and H   C) E and G   D) E and H

5. The correct expression for the multiplication of $4w^2(1 – 3w)$ is

A) $16w$
B) $-8w$
C) $4w^2 + 12w^3$
D) $4w^2 – 12w^3$

6. The correct expression for the multiplication of $(2v + 3)^2$ is

    A) $4v^2 + 9$ B) $4v^2 + 12v + 9$ C) $4v + 9$ D) $4v^2 + 6v + 9$

7. The product of $(x + m)(x + 4)$ is $x^2 + 9x + 20$. The value of m is _____.

Use the following information to answer the next question.

A math student was asked to compare the multiplication of $(2x +1)(3x + 8)$ with the multiplication of the integers $(2 + 1)(3 + 8)$.

8.a) For the integers, the numbers in the brackets can be added to get $(3)(11)$. We now know then that the product is 33. **Explain** why this can't be done given $(2x + 1)(3x + 8)$.

b) **Illustrate** the box method for multiplying $(2x + 1)(3x + 8)$ and **determine** a simplified expression.

c) **Verify** that $x = 2$ satisfies both the original binomial expression of $(2x + 1)(3x + 8)$ and the simplified expression determined in b) above.

A math student was asked to multiply (4x + 1) (3x + 5). The work for their box model is shown below.

$$4x \quad + \quad 1$$

	4x	1
3x	12x	3x
+		
5	20x	5

Unfortunately there is an error.

1. The correct statement is

   A) Within the box, the incorrect term is (20x) and the final answer should be $12x^2 + 23x + 5$.
   B) Within the box, the incorrect term is (12x) and the final answer should be $12x^2 + 23x + 5$.
   C) Within the box, the incorrect term is (20x) and the final answer should be $35x + 5$.
   D) Within the box, the incorrect term is (12x) and the final answer should be $35x + 5$.

Solution
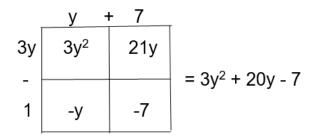
The error occurs in the upper left portion of the box. The student forgot to add the exponents on the letter 'x'. Instead of 12x, it should be $12x^2$.

Thus, the final answer should be $12x^2 + 23x + 5$.

The correct answer is B.

2. The product of (y + 7) (3y − 1) can be written in the form $ay^2 + by − c$, where a, b, and c are integers. The value of b is <u>20</u>.

$$
\begin{array}{c|c|c}
 & y & + \quad 7 \\
\hline
3y & 3y^2 & 21y \\
\hline
- & & \\
\hline
1 & -y & -7
\end{array}
\qquad = 3y^2 + 20y - 7
$$

The value of b is 20.

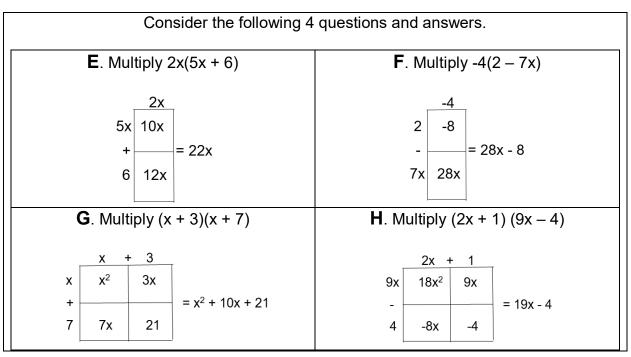Use the following information to answer the next question.

Harley knows that $(6 - 2)(9 + 1)$ must be equal to 40, since $(4)(10) = 40$. But there is a problem when he tries to show it visually with a box.

$$
\begin{array}{c|c|c}
 & 6 & - \quad 2 \\
\hline
9 & 54 & -18 \\
\hline
+ & & \\
\hline
1 & 6 & 2
\end{array}
\qquad = 44
$$

3. Explain the error that Harley made.

Solution

The bottom right corner of the box should be (-2) not (+2), since (1)(-2) = -2.

Now adding 54 + -18 + 6 + -2, the result is 40, which is what Harley knew when he was working with the original question in brackets, i.e. $(6 - 2)(9 + 1)$.

Use the following information to answer the next question.

Consider the following 4 questions and answers.

E. Multiply 2x(5x + 6)	**F**. Multiply -4(2 – 7x)
$$\begin{array}{c|c} & 2x \\ \hline 5x & 10x \\ + & \\ 6 & 12x \end{array} = 22x$$	$$\begin{array}{c|c} & -4 \\ \hline 2 & -8 \\ - & \\ 7x & 28x \end{array} = 28x - 8$$
G. Multiply (x + 3)(x + 7)	**H**. Multiply (2x + 1) (9x – 4)
$$\begin{array}{c|c|c} & x & + \quad 3 \\ \hline x & x^2 & 3x \\ + & & \\ 7 & 7x & 21 \end{array} = x^2 + 10x + 21$$	$$\begin{array}{c|c|c} & 2x & + \quad 1 \\ \hline 9x & 18x^2 & 9x \\ - & & \\ 4 & -8x & -4 \end{array} = 19x - 4$$

4. The two correct answers are

A) F and G   B) F and H   C) E and G   D) E and H

Solution

Question E

This answer is not correct.

The top of the box should be $10x^2$, not 10x. Thus, the correct multiplication should be $10x^2 + 12x$.

Question F

This answer is correct.

Question G

This answer is correct.

Question H

This answer is not correct. All the products within the box are correct. The error occurs when adding the areas of the individual components together. The final answer should be $18x^2 + x – 4$.
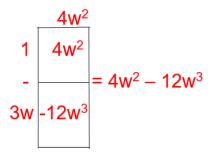
The correct answer is A.

5. The correct expression for the multiplication of $4w^2(1 - 3w)$ is

    A) $16w$
    B) $-8w$
    C) $4w^2 + 12w^3$
    D) $4w^2 - 12w^3$

Solution

Using the distributive property, multiply the monomial $(4w^2)$ by each of the two terms in the brackets.

$4w^2(1 - 3w) = 4w^2 - 12w^3$

Using a rectangular model,

	$4w^2$
1	$4w^2$
-3w	$-12w^3$

$= 4w^2 - 12w^3$

The correct answer is D.

6. The correct expression for the multiplication of $(2v + 3)^2$ is

    A) $4v^2 + 9$ B) $4v^2 + 12v + 9$ C) $4v + 9$ D) $4v^2 + 6v + 9$

Solution

$(2v + 3)^2$ means $(2v + 3)(2v + 3)$

	$2v$	$+$	3
$2v$	$4v^2$		$6v$
$+ 3$	$6v$		9

$= 4v^2 + 12v + 9$

The correct answer is B.

7. The product of $(x + m)(x + 4)$ is $x^2 + 9x + 20$. The value of m is __5__.

Use the following information to answer the next question.

A math student was asked to compare the multiplication of $(2x +1)(3x + 8)$ with the multiplication of the integers $(2 + 1)(3 + 8)$.
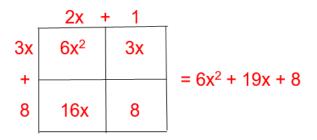
8.a) For the integers, the numbers in the brackets can be added to get (3)(11). We now know then that the product is 33. **Explain** why this can't be done given $(2x + 1)(3x + 8)$.

b) **Illustrate** the box method for multiplying $(2x + 1)(3x + 8)$ and **determine** a simplified expression.

Solution

$= 6x^2 + 19x + 8$

c) **Verify** that x = 2 satisfies both the original binomial expression of $(2x + 1)(3x + 8)$ and the simplified expression determined in b) above.

Solution

Original Binomial Expression	Simplified Product
(2x + 1) (3x + 8)	$6x^2 + 19x + 8$

x = 2

(2(2) + 1) (3(2) + 8)	$6(2)^2 + 19(2) + 8$
(4 + 1) (6 + 8)	24 + 38 + 8
(5) (14)	62 + 8
70 =	**70**