



**THIRD SPACE  
LEARNING**

# Identity Math Worksheet

Algebra

**Grades 9 to 12**

## Skill Questions

Name: .....

Date: .....

1 Verify the identity:  $2\sin x = \frac{2}{\csc x}$

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2 Use the identity  $a^2 - b^2 = (a + b)(a - b)$  to factor the expression  $x^2 - 4$

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3 Use the identity  $(a + b)^2 = a^2 + 2ab + b^2$  to expand  $(3x + y)^2$

4 Use the identity  $(a - b)^2 = a^2 - 2ab + b^2$  to expand  $(x^2 - y^2)^2$

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5 Verify the identity:  $\sin x \sec x = \tan x$

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6 Use the identity  $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$  to expand  $(2x + y)^3$

7 Use the identity  $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$  to expand  $(3x + 4)^3$

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8 Verify the identity:  $\tan x + \sec x = \frac{1 + \sin x}{\cos x}$

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9 Use the identity  $(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$  to expand  $(3x - 1)^3$

## Identity Math Worksheet | Grades 9 to 12

- 10 Use the identity  $(a + b)^4 = a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$  to expand  $(x + 2y)^4$

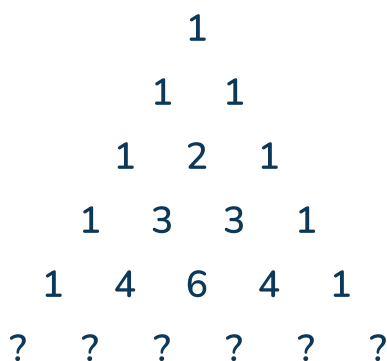
## Applied Questions

- 11** A square garden has an area represented by the expression  $x^2 + 18x + 81$  square units. What expression can be used to represent the length of the side of the square?

Answer

- 12** Using the difference of cubes identity,  $(a^3 - b^3) = (a - b)(a^2 + ab + b^2)$   
Factor the expression,  $(x^3y^3 - 216z^3)$

- 13** Notice the pattern of the numbers in Pascal's triangle. What numbers should be in the missing row?



Answer

- 14 Laura was doing her math homework and when she got to the problem,  $(2x + 3)^2$ , she wrote the answer as  $4x^2 + 9$ . Is her answer correct?

Answer

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- 15 A cube has dimensions represented by  $(x + 3)$ . Represent the volume of the cube in the expanded form of a binomial.

Answer

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# Answers

Question number	Question	Answers	Standard
1	Verify the identity: $2\sin x = \frac{2}{\csc x}$	$\sin x = \frac{1}{\csc x}$ So, substitute $\sin x$ for $\frac{1}{\csc x}$ $2\sin x = 2(\sin x)$ $2\sin x = 2\sin x$	HSF-TF.C.8
2	Use the identity $a^2 - b^2 = (a + b)(a - b)$ factor the expression $x^2 - 4$	Using the identity $a^2 - b^2 = (a + b)(a - b)$ , we can factor $x^2 - 4$ as $(x + 2)(x - 2)$ .	HSA.APR.C.4
3	Use the identity $(a + b)^2 = a^2 + 2ab + b^2$ to expand $(3x + y)^2$	$a = 3x$ $b = y$ $(3x)^2 + 2(3x)(y) + (y)^2$ $9x^2 + 6xy + y^2$	HSA.APR.C.4
4	Use the identity $(a - b)^2 = a^2 - 2ab + b^2$ to expand $(x^2 - y^2)^2$	$a = x^2$ $b = y^2$ $(x^2)^2 - 2(x^2)(y^2) + (y^2)^2$ $x^4 - 2x^2y^2 + y^4$	HSA.APR.C.4
5	Verify the identity: $\sin x \sec x = \tan x$	$\sec x = \frac{1}{\cos x}$ and $\frac{\sin x}{\cos x} = \tan x$ Substitute $\frac{1}{\cos x}$ for $\sec x$ . $\sin x \left( \frac{1}{\cos x} \right) = \tan x$ $\frac{\sin x}{\cos x} = \tan x$ $\tan x = \tan x$	HSF-TF.C.8



# Identity Math Worksheet | Grades 9 to 12 | Answers

Question number	Question	Answers	Standard
6	Use the identity $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$ expand $(2x + y)^3$	$a = 2x$ $b = y$ $(2x)^3 + 3(2x)^2(y) + 3(2x)(y)^2 + (y)^3$ $8x^3 + 12x^2y + 6xy^2 + y^3$	HSA.APR.C.5
7	Use the identity $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$ expand $(3x + 4)^3$	$a = 3x$ $b = 4$ $(3x)^3 + 3(3x)^2(4) + 3(3x)(4)^2 + (4)^3$ $27x^3 + 108x^2 + 96x + 64$	HSA.APR.C.5
8	Verify the identity: $\tan x + \sec x = \frac{1 + \sin x}{\cos x}$	$\tan x = \frac{\sin x}{\cos x}$ and $\sec x = \frac{1}{\cos x}$ substitute those identities into the left side of the equation. $\frac{\sin x}{\cos x} + \left(\frac{1}{\cos x}\right) = \left(\frac{1 + \sin x}{\cos x}\right)$ Because the expressions have a common denominator, add them. $\frac{\sin x + 1}{1 + \sin x} = \frac{1 + \sin x}{\cos x}$	HSF-TF.C.8
9	Use the identity $(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$ expand $(3x - 1)^3$	$a = 3x$ $b = 1$ $(3x)^3 - 3(3x)^2(1) + 3(3x)(1)^2 - (1)^3$ $27x^3 - 27x^2 + 9x - 1$	HSA.APR.C.5

Question number	Question	Answers	Standard
10	Use the identity $(a + b)^4 = a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$ to expand $(x + 2y)^4$	$a = x$ $b = 2y$ $(x)^4 + 4(x)^3(2y) + 6(x)^2(2y)^2 + 4(x)(2y)^3 + (2y)^4$ $x^4 + 8x^3y + 24x^2y^2 + 32xy^3 + 256y^4$	HSA.APR.C.5
11	A square garden has an area represented by the expression $x^2 + 18x + 81$ square units. What expression can be used to represent the length of the side of the square?	The side length of the square is $x + 9$ because $(x + 9)^2$ expanded is $x^2 + 18x + 81$	HSA.APR.C.4
12	Using the difference of cubes identity, $(a^3 - b^3) = (a - b)(a^2 + ab + b^2)$ . Factor the expression, $(x^3y^3 - 216z^3)$	The expression factors to be: $(x^3y^3 - 216z^3) = (xy - 6z)(x^2y^2 + 6xyz + y^2)$	HSA.APR.C.4
13	Notice the pattern of the numbers in Pascal's triangle. What numbers should be in the missing row? <div style="text-align: center;"> 1  1 1  1 2 1  1 3 3 1  1 4 6 4 1  ? ? ? ? ? ? </div>	The last row of numbers are:  1, 5, 10, 10, 5, 1	HSA.APR.C.5
14	Laura was doing her math homework and when she got to the problem, $(2x + 3)^2$ , she wrote the answer as $4x^2 + 9$ . Is her answer correct?	Laura's answer is not correct because she did not multiply or expand the binomial correctly. Using the identity, $(a + b)^2 = a^2 + 2ab + b^2$ $a = 2x$ $b = 3$ $(2x)^2 + 2(2x)(3) + (3)^2$ $4x^2 + 12x + 9$ So, $(2x + 3)^2 = 4x^2 + 12x + 9$	HSA.APR.C.4




Question number	Question	Answers	Standard
15	A cube has dimensions represented by $(x + 3)$ . Represent the volume of the cube in the expanded form of a binomial.	$Volume = (x + 3)(x + 3)(x + 3)$ $Volume = (x + 3)^3$ Using the identity: $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$ $a = x$ $b = 3$ $Volume =$ $x^3 + (3)x^2(3) + 3x(3)^2 + (3)^3$ $Volume =$ $x^3 + 9x^2 + 27x + 27$	HSA.APR.C.5

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