Name: Key

Algebra II

Date: ________

Lesson 1-1

OPERATIONS WITH FUNCTIONS

***Warm Up* #1:** If $g(x) = x^2 + 3x - 4$ and $h(x) = x^3 + 3x^2 - 2x$, what is the difference when $g(x)$ is subtracted from $h(x)$?

switch the order!

(1) $x^3 + 2x^2 - 5x + 4$ (3) $-x^3 + 4x^2 + x - 4$

(2) $x^3 + 2x^2 + x - 4$ (4) $-x^3 - 2x^2 + 5x + 4$

$$x^3 + 3x^2 - 2x - (x^2 + 3x - 4)$$

$$x^3 + 3x^2 - 2x - x^2 - 3x + 4$$

$$\boxed{x^3 + 2x^2 - 5x + 4}$$

multiply

***Warm Up* #2:** If $j(x) = x^2 - 2x + 3$ and $k(x) = x + 1$, what is the product of $j(x)$ and $k(x)$?

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

(2) $x^3 - 2x^2 + 3x$ (4) $x^2 - x + 4$

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

$$x^3 - 2x^2 + 3x + x^2 - 2x + 3$$

$$\boxed{x^3 - x^2 + x + 3}$$

***Example* #1:** According to data from the U.S. Census Bureau for the period 2000-2007, the number of male students enrolled in high school in the United States can be approximated by the function $M(x) = -0.004x^3 + 0.037x^2 + 0.049x + 8.11$ where x is the number of years since 2000 and $M(x)$ is the number of male students in millions. The number of female students enrolled in high school in the United States can be approximated by the function $F(x) = -0.006x^3 + 0.029x^2 + 0.165x + 7.67$ where x is the number of years since 2000 and $F(x)$ is the number of female students in millions.

→ M + F

Write a polynomial function, $T(x)$, to represent the total number of students enrolled in high school in the United States.

$T(x) = M(x) + F(x)$

$T(x) = -.004x^3 + .037x^2 + .049x + 8.11 + -.006x^3 + .029x^2 + .165x + 7.67$

$\boxed{T(x) = -0.01x^3 + 0.066x^2 + 0.214x + 15.78}$

Using the function $T(x)$, find the number of students enrolled in high school in the United States in 2007.

$\boxed{T(7) = 17.082}$

↑ $x = 7$

↑ plug in 7 for x

***Example* #2:** A manufacturing company has developed a cost model, $C(x) = 0.15x^3 + 0.01x^2 + 2x + 120$, where x is the number of items sold, in thousands. The sales price can be modeled by $S(x) = 30 - 0.01x$. Therefore, revenue is modeled by $R(x) = x \bullet S(x)$. The company's profit, $P(x) = R(x) - C(x)$, could be modeled by

(1) $0.15x^3 + 0.02x^2 - 28x + 120$

(2) $-0.15x^3 - 0.02x^2 + 28x - 120$

(3) $-0.15x^3 + 0.01x^2 - 2.01x - 120$

(4) $-0.15x^3 + 32x + 120$

$R(x) = x \cdot S(x)$

$R(x) = x(30 - 0.01x)$

$R(x) = 30x - .01x^2$

$P(x) = R(x) - C(x)$

$P(x) = 30x - .01x^2 - (0.15x^3 + 0.01x^2 + 2x + 120)$

$P(x) = 30x - .01x^2 - 0.15x^3 - 0.01x^2 - 2x - 120$

$P(x) = -0.15x^3 - 0.02x^2 + 28x - 120$

Name: ANSWER KEY

Date: ________

Algebra II

Lesson 1-1

OPERATIONS WITH FUNCTIONS PRACTICE QUESTIONS

1. If $f(x)=\frac{4}{3}x^3-\frac{5}{8}x^2+\frac{7}{9}x$ and $g(x)=2x^3+\frac{3}{4}x^2-\frac{2}{9}$, what is the difference when $f(x)$ is subtracted from $g(x)$?

$$g(x)-f(x) = 2x^3+\frac{3}{4}x^2-\frac{2}{9}-\left(\frac{4}{3}x^3-\frac{5}{8}x^2+\frac{7}{9}x\right)$$
$$= 2x^3+\frac{3}{4}x^2-\frac{2}{9}-\frac{4}{3}x^3+\frac{5}{8}x^2-\frac{7}{9}x$$
$$= \boxed{\frac{2}{3}x^3+\frac{11}{8}x^2-\frac{7}{9}x-\frac{2}{9}}$$

2. According to data from the U.S. Census Bureau, the total number of people in the United States labor force can be approximated by the function $T(x)=-0.011x^2+2x+107$, where x is the number of years since 1980 and $T(x)$ is the number of workers in millions. The number of women in the United States labor force can be approximated by the function $W(x)=-0.012x^2+1.26x+45.5$.

Write a polynomial function $M(x)$ that models the number of men in the labor force.

$$M(x) = T(x) - W(x)$$
$$M(x) = -0.011x^2+2x+107-(-0.012x^2+1.26x+45.5)$$
$$M(x) = -0.011x^2+2x+107+0.012x^2-1.26x-45.5$$
$$\boxed{M(x) = 0.001x^2+0.74x+61.5}$$

Using the function $M(x)$, find the number of men in the labor force in 2008.

$x=28$

$$M(28) = 0.001(28)^2+0.74(28)+61.5$$
$$M(28) = \boxed{83.004 \text{ million men}}$$

3. If $f(y)=\frac{1}{2}y^2-\frac{1}{3}y$ and $g(y)=12y+\frac{3}{5}$, express the product of $f(y)$ and $g(y)$ as a trinomial.

$$f(y)\cdot g(y) = \left(\frac{1}{2}y^2-\frac{1}{3}y\right)\left(12y+\frac{3}{5}\right)$$
$$= 6y^3+\frac{3}{10}y^2-4y^2-\frac{1}{5}y$$
$$= \boxed{6y^3-\frac{37}{10}y^2-\frac{1}{5}y}$$

4. Express the product of $(x-6y)$ and $(5x+6y)$ as a trinomial.

$$(x-6y)(5x+6y)$$
$$5x^2+6xy-30xy-36y^2$$
$$\boxed{5x^2-24xy-36y^2}$$

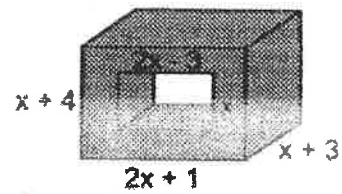
5. If the difference $(3x^2 - 2x + 5) - (x^2 + 3x - 2)$ is multiplied by $\frac{1}{2}x^2$, what is the result, written in standard form?

$\frac{1}{2}x^2(3x^2 - 2x + 5 - x^2 - 3x + 2)$

$\frac{1}{2}x^2(2x^2 - 5x + 7)$

$\boxed{x^4 - \frac{5}{2}x^3 + \frac{7}{2}x^2}$

6. A designer has hollowed out a block of wood as shown. Express the volume of the remaining figure in terms of x.



Rectangular solid with a rectangular solid hollowed out of the center.

Large Volume = $(x+4)(2x+1)(x+3)$

Small Volume = $x(2x-3)(x+3)$

Large Volume - Small volume

$2x^3 + 15x^2 + 31x + 12 - (2x^3 + 3x^2 - 9x)$

$2x^3 + 15x^2 + 31x + 12 - 2x^3 - 3x^2 + 9x$

$\boxed{12x^2 + 40x + 12}$

Large Volume

$(x+4)(2x+1)(x+3)$

$(x+4)(2x^2 + 6x + x + 3)$

$(x+4)(2x^2 + 7x + 3)$

$2x^3 + 7x^2 + 3x + 8x^2 + 28x + 12$

$2x^3 + 15x^2 + 31x + 12$

Small Volume

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

$x(2x^2 + 6x - 3x - 9)$

$x(2x^2 + 3x - 9)$

$2x^3 + 3x^2 - 9x$

Answers

1. $\frac{2}{3}x^3 + \frac{11}{8}x^2 - \frac{7}{9}x - \frac{2}{9}$
2. $M(x) = 0.001x^2 + 0.74x + 61.5$, 83.004
3. $6y^3 - \frac{37}{10}y^2 - \frac{3}{15}y = 6y^3 - \frac{37}{10}y^2 - \frac{1}{5}y$
4. $5x^2 - 24xy - 36y^2$
5. $x^4 - \frac{5}{2}x^3 + \frac{7}{2}x^2$
6. $12x^2 + 40x + 12$