

HW 5 - 1 Answers

1. $3(x^2 - 2)(x + 7)$
2. $(5y + 7)(2x + 3)$
3. $(x + 9)(x^2 - 2)$
4. $(4x - 1)(x + 7)$
5. $-9(2x + 3)$
6. $(3x + 4)(2x - 3)$
7. $(4x + 1)(2x - 3)$
8. $(x - 5)(x + 1)(x - 2)^2$
9. $(5 - x)(25 + 5x + x^2)$
10. $(2y^2 - 3)(4y^4 + 6y + 9)$

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Factor each of the following:

1. $3x^3 + 21x^2 - 6x - 42$
 $= 3x^2(x+7) - 6(x+7)$
 $= (3x^2 - 6)(x+7)$
 $= 3(x^2 - 2)(x+7)$
2. $10xy + 14x + 15y + 21$
 $= 2x(5y+7) + 3(5y+7)$
 $= (5y+7)(2x+3)$
3. $x^3 + 9x^2 - 2x - 18$
 $= x^2(x+9) - 2(x+9)$
 $= (x+9)(x^2 - 2)$
4. $(4x - 1)(3x + 2) - (4x - 1)(2x - 5)$
 $= (4x - 1)(3x + 2 - (2x - 5))$
 $= (4x - 1)(3x + 2 - 2x + 5)$
 $= (4x - 1)(x + 7)$

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5. $(2x + 3)(x - 4) - (2x + 3)(x + 5)$
 $= (2x+3)(x-4-(x+5))$
 $= (2x+3)(x-4-x-5)$
 $= -9(2x+3)$
6. $6x^2 - x - 12$
 $= 6x^2 - 9x + 8x - 12$
 $= 3x(2x-3) + 4(2x-3)$
 $= (2x-3)(3x+4)$
7. $8x^2 - 10x - 3$
 $= 8x^2 - 12x + 2x - 3$
 $= 4x(2x-3) + 1(2x-3)$
 $= (2x-3)(4x+1)$
8. $(x^2 - 4x)^2 - (x^2 - 4x) - 20$
 $\text{Let } u = x^2 - 4x$
 $u^2 - u - 20$
 $= (u-5)(u+4)$
 $= (x^2 - 4x - 5)(x^2 - 4x + 4)$
 $= (x-5)(x+1)(x-2)(x-2)$
 $= (x-5)(x+1)(x-2)^2$

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9. $125 - x^3$
 $a = 5$
 $b = x$
 $(5-x)(25+5x+x^2)$
10. $8y^3 - 27$
 $a = 2y$
 $b = 3$
 $(2y-3)(4y^2+6y+9)$

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Factor each of the following completely.
 Hint: you may need to use substitution to make the question look more familiar.
 Finish for HW any problems you did not complete in class.

1. $(x^2 + 3x)^2 - 2(x^2 + 3x) - 8$
 $\text{Let } u = (x^2 + 3x)$
 $u^2 - 2u - 8$
 $(u-4)(u+2)$
 $(x^2 + 3x - 4)(x^2 + 3x + 2)$
 $= (x+4)(x-1)(x+2)(x+1)$
2. $(x^2 - x)^2 - 8(x^2 - x) + 12$
 $\text{Let } u = (x^2 - x)$
 $u^2 - 8u + 12$
 $(u-6)(u-2)$
 $(x^2 - x - 6)(x^2 - x - 2)$
 $= (x-3)(x+2)(x-2)(x+1)$

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3. $x^4 - 3x^2 - 10 + 4x^2 + 8x$
 $(x^2 - 5)(x^2 + 2) + 4x(x^2 + 2)$
 $(x^2 + 2)(x^2 + 4x - 5)$
 $= (x^2 + 2)(x+5)(x-1)$
4. $x^4 - 7x^2 - 18 + x^2 - 9x$
 $(x^2 - 9)(x^2 + 2) + x(x^2 - 9)$
 $= (x^2 - 9)(x^2 + x + 2)$
 $= (x+3)(x-3)(x^2 + x + 2)$

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5. $x^4 + 2x^3 - 8x - 16$
 $= x^3(x+2) - 8(x+2)$
 $= (x+2)(x^3 - 8)$ $\sqrt[3]{8}$
 $= (x+2)(x-2)(x^2 + 2x + 4)$
 Aside:
 $x^3 - 8 = (x-2)(x^2 + 2x + 4)$
 $a = x$
 $b = 2$

6. $x^6 + 2x^4 - 16x^2 - 32$
 $= x^4(x^2 + 2) - 16(x^2 + 2)$
 $= (x^2 + 2)(x^4 - 16)$
 $= (x^2 + 2)(x^2 + 4)(x^2 - 4)$
 $= (x^2 + 2)(x^2 + 4)(x+2)(x-2)$

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7. Let x and y be integers such that $x^3 - y^3 = 48$. If $x - y = 3$ and $3xy = 18$, what is $x^2 + y^2$?
 $a = x$
 $b = y$
 $x^3 - y^3 = 48$
 $(x-y)(x^2 + xy + y^2) = 48$
 $\downarrow$
 $\frac{3(x^2 + y^2 + xy)}{3} = \frac{48}{3}$
 $x^2 + y^2 + xy = 16$
 $x^2 + y^2 = 10$

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8. If $(2x^3 + bx - 10)(x + 5) = 2x^3 + 17x^2 + 25x - 50$ is true for all values of x , what is b ?
 $x(2x^3 + bx - 10) + 5(2x^3 + bx - 10) = 2x^3 + 17x^2 + 25x - 50$
 $2x^3 + bx^2 - 10x + 10x^3 + 5bx - 50 = 2x^3 + 17x^2 + 25x - 50$
 $-2x^3 \quad \quad \quad +50 \quad -2x^3 \quad \quad +50$

 $bx^2 + 10x^2 - 10x + 5bx = 17x^2 + 25x$
 $-10x^2 + 10x \quad -10x^2 + 10x$

 $bx^2 + 5bx = 7x^2 + 35x$
 $bx^2 = 7x^2 \quad 5bx = 35x$
 $b = 7 \quad b = 7$

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9. If $(2x + 3)(4x^2 - 5x + 6) = ax^3 + bx^2 + cx + d$, what is the value of $2b + c$?
 $2x(4x^2 - 5x + 6) + 3(4x^2 - 5x + 6)$
 $8x^3 - 10x^2 + 12x + 12x^2 - 15x + 18$
 $8x^3 + 2x^2 - 3x + 18$
 $a = 8 \quad c = -3$
 $b = 2 \quad d = 18$
 $2b + c = 2(2) + (-3)$
 $= 1$

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10. From Alg2CC Regents January 2017
 Algebraically determine the values of h and k to correctly complete the identity stated below:
 $2x^3 - 10x^2 + 11x - 7 = (x - 4)(2x^2 + hx + 3) + k$
 $2x^3 - 10x^2 + 11x - 7 = x(2x^2 + hx + 3) - 4(2x^2 + hx + 3) + k$
 $2x^3 - 10x^2 + 11x - 7 = 2x^3 + hx^2 + 3x - 8x^2 - 4hx - 12 + k$
 $-2x^3 \quad \quad \quad -2x^3$

 $-10x^2 + 11x - 7 = hx^2 - 8x^2 - 4hx + 3x - 12 + k$
 $-10x^2 = hx^2 - 8x^2 \quad 11x = -4hx + 3x \quad -7 = -12 + k$
 $-2x^2 = hx^2 \quad 8x = -4hx \quad 5 = k$
 $-2 = h \quad -2 = h$

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11. Similar question
 Algebraically determine the values of h and k to correctly complete the identity stated below:
 $3x^3 - 2x^2 - 13x + 8 = (x - 2)(3x^2 + hx - 5) + k$
 $3x^3 - 2x^2 - 13x + 8 = x(3x^2 + hx - 5) - 2(3x^2 + hx - 5) + k$
 $3x^3 - 2x^2 - 13x + 8 = 3x^3 + hx^2 - 5x - 6x^2 - 2hx + 10 + k$
 $-2x^2 = hx^2 - 6x^2 \quad -13x = -5x - 2hx \quad 8 = 10 + k$
 $4x^2 = hx^2 \quad -8x = -2hx \quad -2 = k$
 $4 = h \quad 4 = h$

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