MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECTION 1.3 | **Math 1090 Worksheet** | FALL 2026

SOLUTIONS

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

   (b) We have

$$\begin{aligned}
&-2(x-5)+(2x-3)^2-(x+2)(x-4)\\
&=(-2x+10)+(4x^2-6x-6x+9)-(x^2-4x+2x-8)\\
&=-2x+10+4x^2-6x-6x+9-x^2+4x-2x+8\\
&=3x^2-12x+27.
\end{aligned}$$

2. (a) Both terms have a factor of $3x^2$, so we write

$$6x^3+9x^2 = 3x^2\cdot 2x + 3x^2 \cdot 3 = 3x^2(2x+3).$$

   (b) This is a difference of squares:

$$49x^2-16 = (7x)^2-4^2 = (7x-4)(7x+4).$$

   (c) This is a sum of squares, so it cannot be factored any further.

   (d) This is a difference of squares:

$$x^4-1 = (x^2)^2-1^2 = (x^2-1)(x^2+1) = (x-1)(x+1)(x^2+1).$$

   (e) The integers whose product is 6 are $1\cdot 6 = 6$, $-1\cdot(-6)=6$, $2\cdot 3 = 6$ and $-2\cdot(-3)=6$. Checking these possibilities, we see that

$$x^2-7x+6 = (x-6)(x-1).$$

   (f) Again, the integers whose product is 6 are $1\cdot 6 = 6$, $-1\cdot(-6)=6$, $2\cdot 3 = 6$ and $-2\cdot(-3)=6$. This time, we find that

$$x^2-5x+6 = (x-3)(x-2).$$

   (g) The integers whose product is 24 are $1\cdot 24 = 24$, $-1\cdot(-24)=24$, $2\cdot 12 = 24$, $-2\cdot -12 = 24$, $3\cdot 8 = 24$, $-3\cdot(-8) = 24$, $4\cdot 6 = 24$ and $-4\cdot(-6)=24$. This leads to

$$x^2+5x-24 = (x+8)(x-3).$$

(h) The integers whose product is 8 are $1 \cdot 8 = 8$, $-1 \cdot (-8) = 8$, $2 \cdot 4 = 8$, $-2 \cdot (-4) = 8$. The positive integers whose product is 4 are $1 \cdot 4 = 4$ and $2 \cdot 2 = 4$. Thus the possible factored forms are $(x+1)(4x+8)$, $(4x+1)(x+8)$, $(2x+1)(2x+8)$, $(x-1)(4x-8)$, $(4x-1)(x-8)$, $(2x-1)(2x-8)$, $(x+2)(4x+4)$, $(4x+2)(x+4)$, $(2x+2)(2x+4)$, $(x-2)(4x-4)$, $(4x-2)(x-4)$ and $(2x-2)(2x-4)$. We find that

$$4x^2 + 18x + 8 = (2x+8)(2x+1) = 2(x+4)(2x+1).$$

(i) The integers whose product is 25 are $1 \cdot 25 = 25$, $-1 \cdot (-25) = 25$, $5 \cdot 5 = 25$ and $-5 \cdot (-5) = 25$. The positive integers whose product is 9 are $1 \cdot 9 = 9$ and $3 \cdot 3 = 9$. Thus the possible factored forms are $(x+1)(9x+25)$, $(9x+1)(x+25)$, $(3x+1)(3x+25)$, $(x-1)(9x-25)$, $(9x-1)(x-25)$, $(3x-1)(3x-25)$, $(x+5)(9x+5)$, $(3x+5)(3x+5)$, $(x-5)(9x-5)$ and $(3x-5)(3x-5)$. We discover that

$$9x^2 - 30x + 25 = (3x-5)(3x-5) = (3x-5)^2.$$

(j) The integers whose product is -6 are $1 \cdot (-6) = -6$, $-1 \cdot 6 = -6$, $2 \cdot (-3) = -6$ and $-2 \cdot 3 = -6$. The positive integers whose product is 12 are $1 \cdot 12 = 12$, $2 \cdot 6 = 12$ and $3 \cdot 4 = 12$. Thus the possible factored forms are $(x+1)(12x-6)$, $(12x+1)(x-6)$, $(2x+1)(6x-6)$, $(6x+1)(2x-6)$, $(3x+1)(4x-6)$, $(4x+1)(3x-6)$, $(x-1)(12x+6)$, $(12x-1)(x+6)$, $(2x-1)(6x+6)$, $(6x-1)(2x+6)$, $(3x-1)(4x+6)$, $(4x-1)(3x+6)$, $(x+2)(12x-3)$, $(12x+2)(x-3)$, $(2x+2)(6x-3)$, $(6x+2)(2x-3)$, $(3x+2)(4x-3)$, $(4x+2)(3x-3)$, $(x-2)(12x+3)$, $(12x-2)(x+3)$, $(2x-2)(6x+3)$, $(6x-2)(2x+3)$, $(3x-2)(4x+3)$ and $(4x-2)(3x+3)$. Whew! After lots of checking — or getting pretty lucky and finding it quickly — we recognise that

$$12x^2 - x - 6 = (4x-3)(3x+2).$$

(k) First we write this trinomial as

$$4 + 19x - 5x^2 = -(5x^2 - 19x - 4).$$

Now we can concentrate on factoring $5x^2 - 19x - 4$. The integers whose product is -4 are $1 \cdot (-4) = -4$, $-1 \cdot 4 = -4$ and $2 \cdot (-2) = -4$. The positive integers whose product is 5 are only $1 \cdot 5 = 5$. Thus the possible factored forms are $(x+1)(5x-4)$, $(5x+1)(x-4)$, $(x-1)(5x+4)$, $(5x-1)(x+4)$, $(x+2)(5x-2)$ and $(5x+2)(x-2)$. We find that

$$5x^2 - 19x - 4 = (5x+1)(x-4)$$

and so

$$4 + 19x - 5x^2 = -(5x+1)(x-4).$$

(l) This is a trinomial with x^2 in place of x. The integers whose product is 4 are $1 \cdot 4 = 4$, $-1 \cdot (-4) = 4$, $2 \cdot 2 = 4$ and $-2 \cdot (-2) = 4$. This leads to

$$x^4 + 5x^2 + 4 = (x^2+4)(x^2+1)$$

which cannot be factored any further because both expressions are sums of squares.

(m) This is almost identical to the previous polynomial, except this time we find that

$$x^4 - 5x^2 + 4 = (x^2 - 4)(x^2 - 1).$$

This time, both expressions are differences of squares and therefore can be further factored. Hence we have

$$x^4 - 5x^2 + 4 = (x-2)(x+2)(x-1)(x+1).$$

(n) This is a sum of cubes:

$$8x^3 + 27 = (2x)^3 + 3^3 = (2x+3)[(2x)^2 - (2x)(3) + (3)^2] = (2x+3)(4x^2 - 6x + 9).$$

(o) All the terms have a factor of $-2x$:

$$14x^2 - 2x^3 - 20x = -2x(x^2 - 7x + 10) = -2x(x-2)(x-5).$$

(p) We can factor by grouping:

$$\begin{aligned} x^3 + 2x^2 - 4x - 8 &= x^2(x+2) - 4(x+2) \\ &= (x+2)(x^2-4) \\ &= (x+2)(x-2)(x+2) \\ &= (x-2)(x+2)^2. \end{aligned}$$