3.3 # 17, 19, 21, 35a, 39a, 43, 46

17. $f(x) = 2x^3 - 3x^2 + 17x + 30$ $\quad k = 2$

First divide out (x-2):

$$\begin{array}{r|rrrr} 2 & 2 & -3 & -17 & 30 \\ & & 4 & 2 & -30 \\ \hline & 2 & 1 & -15 & 0 \end{array}$$

Write the partial factorization:

$f(x) = (x-2)(2x^2 + x - 15)$

Factor the quadratic part:

$2x^2 + x - 15 = (2x-5)(x+3)$

Write the complete factorization:

$f(x) = (x-2)(2x-5)(x+3)$

19. $f(x) = 6x^3 + 13x^2 - 14x + 3$ $\quad k = -3$

First divide out (x- -3) = (x+3):

$$\begin{array}{r|rrrr} -3 & 6 & 13 & -14 & 3 \\ & & -18 & 15 & -3 \\ \hline & 6 & -5 & 1 & 0 \end{array}$$

Write the partial factorization:

$f(x) = (x+3)(6x^2 - 5x + 1)$

Factor the quadratic part:

$6x^2 - 5x + 1 = (3x-1)(2x-1)$

Write the complete factorization:

$f(x) = (x+3)(3x-1)(2x-1)$

21. $f(x) = 6x^3 + 25x^2 + 3x - 4$ $\quad$ k = -4

First divide out $(x - -4) = (x+4)$

$$\begin{array}{r|rrrr} -4 & 6 & 25 & 3 & -4 \\ & & -24 & -4 & 4 \\ \hline & 6 & 1 & -1 & 0 \end{array}$$

Write the partial factorization:

$f(x) = (x+4)(6x^2 + x - 1)$

Factor the quadratic part:

$6x^2 + x - 1 = (3x-1)(2x+1)$

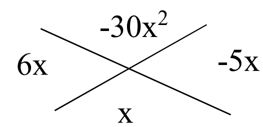
Write the complete factorization:

$f(x) = (x+4)(3x-1)(2x+1)$

Factoring quadratics with the box strategy reminder for the # 17:

$2x^2 + x - 15 = (2x-5)(x+3)$

Write the product of the first and last terms on top of the x, and the middle term on the bottom. Look for things that give a product (multiplication) of the term on top, and a sum (addition) of the term on the bottom:



Put the first term in top left of the box and the constant term in the bottom right. Put the terms you figured out in the previous step in the other two parts of the box. Then factor out common terms. Make sure that each thing in the box is the product of the things above and to the left of it:

	x	3
$2x$	$2x^2$	$6x$
-5	$-5x$	-15

The terms on the top and left are the factors:

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

Always multiply out to check your factorization!

35a. $f(x) = x^3 - 2x^2 - 13x - 10$

Make your own clues problem! Write down the possible clues. Use factors of the last term (-10) in the numerator, and factors of the first coefficient (1) in the denominator. Don't forget both positive and negative possibilities:

$\pm\frac{1}{1},\ \pm\frac{2}{1},\ \pm\frac{5}{1},\ \pm\frac{10}{1}$ or write it: $\pm 1, \pm 2, \pm 5, \pm 10$

39a. $f(x) = 6x^3 + 17x^2 - 31x - 12$

Use factors of -12 in the numerator and factors of 6 in the denominator and write out all of the possibilities:

$\pm\frac{1}{1}, \pm\frac{2}{1}, \pm\frac{3}{1}, \pm\frac{4}{1}, \pm\frac{6}{1}, \pm\frac{12}{1},$

$\pm\frac{1}{2}, \pm\frac{2}{2}, \pm\frac{3}{2}, \pm\frac{4}{2}, \pm\frac{6}{2}, \pm\frac{12}{2},$

$\pm\frac{1}{3}, \pm\frac{2}{3}, \pm\frac{3}{3}, \pm\frac{4}{3}, \pm\frac{6}{3}, \pm\frac{12}{3},$

$\pm\frac{1}{6}, \pm\frac{2}{6}, \pm\frac{3}{6}, \pm\frac{4}{6}, \pm\frac{6}{6}, \pm\frac{12}{6},$

Then simplify the fractions and cross out the numbers that appear twice:

$\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12,$

$\pm\frac{1}{2}, \cancel{\pm 1}, \pm\frac{3}{2}, \cancel{\pm 2}, \cancel{\pm 3}, \cancel{\pm 6},$

$\pm\frac{1}{3}, \pm\frac{2}{3}, \cancel{\pm 1}, \pm\frac{4}{3}, \cancel{\pm 2}, \cancel{\pm 4},$

$\pm\frac{1}{6}, \cancel{\pm\frac{1}{3}}, \cancel{\pm\frac{1}{2}}, \cancel{\pm\frac{2}{3}}, \cancel{\pm 1}, \cancel{\pm 2}$

So the final list is:

$\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12, \pm\frac{1}{2}, \pm\frac{3}{2}, \pm\frac{1}{3}, \pm\frac{2}{3}, \pm\frac{4}{3}, \pm\frac{1}{6}$

43. $f(x) = (x-2)^3(x^2-7)$

Start by factoring and finding the zeros of any parts that aren't already factored:

$x^2 - 7 = 0$

$x^2 = 7$

$x = \pm\sqrt{7}$

$x^2 - 7 = (x - \sqrt{7})(x + \sqrt{7})$

Each different factor corresponds to a zero. The multiplicity is the exponent on the factor (the number of times the factor appears in the factorization).

Final Answer:

2 is a zero with multiplicity 3

$\sqrt{7}$ is a zero with multiplicity 1

$-\sqrt{7}$ is a zero with multiplicity 1

46. $f(x) = 5x^2(x^2 - 16)(x + 5)$

Start by finding the zeros of any parts that aren't already factored:

$x^2 - 16 = (x-4)(x+4)$

Tricky thing to notice: x^2 contributes a zero of 0. 5 doesn't contribute anything to the number of zeros:

Final answer:

0 is a zero with multiplicity 2

4 is a zero with multiplicity 1

-4 is a zero with multiplicity 1

-5 is a zero with multiplicity 1