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This problem is very similar to Example 6b on Page 287

57. $M(t) = 18t^3 - 21t^2 + 10t - 2$

Possible rational zeros: $\pm \frac{1, 2}{1, 2, 3, 6, 9, 18}$

$= \pm\left(1, \frac{1}{2}, \frac{1}{3}, \frac{1}{6}, \frac{1}{9}, \frac{1}{18}, 2, \frac{2}{3}, \frac{2}{9}\right)$

Calculator gives $t = \frac{1}{2}$ as a possibility

Confirm it:

$$\begin{array}{c|cccc} \frac{1}{2} & 18 & -21 & 10 & -2 \\ & \downarrow & 9 & -6 & 2 \\ \hline & 18 & -12 & 4 & \boxed{0} \end{array} \leftarrow \text{Confirmed}$$

$M(t) = \left(t - \frac{1}{2}\right)(18t^2 - 12t + 4)$

Remaining zeros come from

$18t^2 - 12t + 4 = 0$

$9t^2 - 6t + 2 = 0$

$t = \frac{6 \pm \sqrt{36 - 4(9)(2)}}{2(9)}$

$= \frac{6 \pm \sqrt{-36}}{18} = \frac{6 \pm 6i}{18} = \boxed{\frac{1 \pm i}{3}}$

The 3 zeros are $\frac{1}{2}, \frac{1+i}{3}, \frac{1-i}{3}$

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No examples in the book similar to this.

59. $S(w) = w^4 + w^3 - w^2 + w - 2$

Possible zeros: $\pm 1, \pm 2$

Calculator gives $w = 1$ as a possibility.

Confirm it:

1	1	1	−1	1	−2
	↓	1	2	1	2
	1	2	1	2	0

Confirmed

Calculator also gives $w = -2$ as a possibility

Confirm it

−2	1	2	1	2
	↓	−2	0	−2
	1	0	1	0

Confirmed

Our work so far tells us this:

$$S(w) = (x-1)(x+2)(x^2+1)$$

$$\Rightarrow \quad x = 1, \; x = -2, \; x^2 = -1$$

$$x = \pm\sqrt{-1} = \pm i$$

Our zeros are $1, -2, \pm i$

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Problem 61

No examples in the book similar to this.

Find all zeros for $V(x) = x^4 + 2x^3 - x^2 - 4x - 2$

Possible rational zeros: $\pm 1, \pm 2$

My calculator shows $x = -1$ is a possibility,

So I check it with division:

You need to write this

This tells us we can write V(x) like this

$$\begin{array}{r|ccccc} -1 & 1 & 2 & -1 & -4 & -2 \\ & \downarrow & -1 & -1 & 2 & 2 \\ \hline & 1 & 1 & -2 & -2 & \boxed{0} \end{array}$$

This shows that -1 is a zero

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

Factor by grouping

$$= (x+1)\left[x^2(x+1) - 2(x+1)\right]$$

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

If you don't want to factor, you can continue using your calculator, or division

$x + 1 = 0$ $\qquad$ $x^2 - 2 = 0$

$\Rightarrow \boxed{x = -1}$ $\qquad$ $\Rightarrow x^2 = 2$

$\boxed{x = \pm\sqrt{2}}$

What will you get if you multiply $(x+1)(x+\sqrt{2})(x-\sqrt{2})$?