Section 3.2
Solutions and Hints

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for the book:

Precalculus, Mathematics for Calculus 4th Edition
by James Stewart, Lothar Redlin and Saleem Watson.

12. Use synthetic division to find the quotient and remainder of:
$(x^2 – 5x + 4) / (x – 1)$

Notice Long Division Sets stuff up like this:

$$x - 1 \,\overline{\big|\, x^2 - 5x + 4}$$

Synthetic division just uses the coefficients:
NOTICE that the divisor is in the form of (x – c) ← emphasis on the MINUS

First we bring down the leading 1:

1	1	-5	4
	1		

Now we multiply 1 * 1 = 1 and place the result under the –5 and add (-5 + 1)

1	1	-5	4
		1	
	1	-4	

Now we multiply 1 * -4 = -4 and place the result under the 4 and add (4 + -4)

1	1	-5	4
		1	-4
	1	-4	0

And we get our answer: **Quotient = (1x – 4) Remainder = 0**

14. Use synthetic division to find the quotient and remainder of: $(4x^2 - 3) / (x + 5)$

NOTICE that the divisor is in the form of (x – c) ← emphasis on the MINUS

So (x + 5) = (x - -5)

Also note that there is no x to the first power in the dividend, so we rewrite it:

$(4x^2 - 3) = (4x^2 + 0x - 3)$

First we bring down the leading 4:

-5	4	0	-3
	4		

Multiply –5 * 4 and place the result under the 0 and add

-5	4	0	-3
		-20	
	4	-20	

Multiply –5 * -20 and place the result under the -3 and add

-5	4	0	-3
		-20	100
	4	-20	97

So the **Quotient = (4x – 20) with Remainder = 97**

This can also be written: $\frac{4x^2 - 3}{x + 5} = 4x - 20 + \frac{97}{x + 5}$

Just like 20/3 → quotient = 6 and remainder = 2, so $\frac{20}{3} = 6 + \frac{2}{3}$

36. Use synthetic division and the Remainder Theorem to evaluate P(c) for: $P(x) = x^3 - x + 1$, $c = ¼$.

While this may seem silly, since you can just put ¼ into P(x) and get the answer, this technique is actually used in computer systems because it reduces the number of multiplies necessary to find the answer (multiplies take a "long" time to perform).

So we divide P(x) by (x – ¼)
Notice $x^3 - x + 1 = x^3 + 0x^2 - x + 1$

First we bring down the leading 1:

¼	1	0	-1	1
	1			

Multiply ¼ * 1 and place the result under the 0 and add:

¼	1	0	-1	1
		¼		
	1	¼		

Multiply ¼ * ¼ and place the result under the -1 and add:

¼	1	0	-1	1
		¼	1/16	
	1	¼	-15/16	

Multiply ¼ * -15/16 and place the result under the 1 and add:

¼	1	0	-1	1
		¼	1/16	-15/64
	1	¼	-15/16	49/64

The remainder comes out to be 49/64 so we say **P(¼) = 49/64**
(All for 3 multiplies and 3 adds)