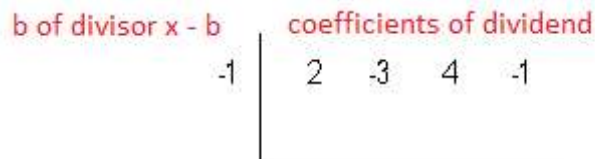# 1.6 Synthetic Division (Optional)

Synthetic division is another way to divide a polynomial by the binomial $x - b$, where $b$ is a constant.

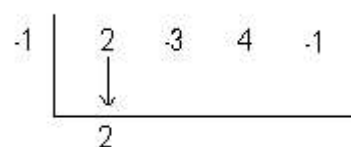**Example**: Divide $2x^3 - 3x^2 + 4x - 1$ by $x + 1$ use synthetic division.

## Step 1

The root of divisor (b value) goes on the outside of the box. The dividend coefficients go on the inside of the box.

*When you write out the dividend make sure that you write it in descending powers and you insert 0's for any missing terms.*
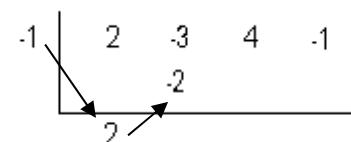
## Step 2

Bring down the leading coefficient to the bottom row

❖ **Bring down the 2**

## Step 3

Multiply this by the **b** value ( in this case -1), and carry the
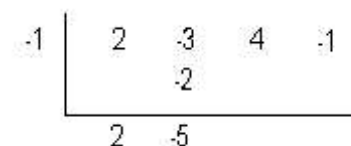
result up into the next column:

❖ **(-1)(2) = -2**
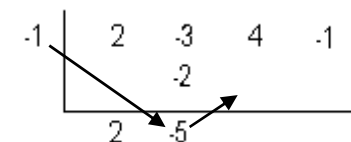❖ **Place -2 in next column**

## Step 4

Add down the column

❖ **-3 + (-2) = -5**

## Step 5

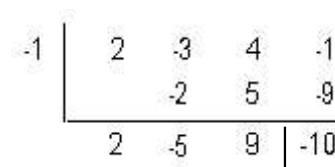Multiply the previous result by the **b** value, and carry the new resul

❖ **(-1)(-5) = 5**
❖ **Place 5 in next column**

**Step 6** Repeat until down

The numbers in the last row make up your coefficients of the

quotient as well as the remainder.

The final value on the right is the remainder. Working right to left, the next number is your constant, the next is the coefficient for $x$, the next is the coefficient for $x^2$ , etc.

**In this example, the remainder is -10 and the quotient is $x^2$-5x+9.**

**Practice**

1. Complete the indicated division.

$$
\begin{array}{c|ccccc}
2 & 2 & -3 & -5 & 3 & 8 \\
  &   &    &    &   &   \\
\hline
  &   &    &    &   &   \\
\end{array}
$$

2. Divide $3x^3 - 2x^2 + 3x - 4$ by $x - 3$ using synthetic division.  Write the answer in the form

$$\frac{P(x)}{x-b} = Q(x) + \frac{R}{x-b}$$

3. Divide $2x^3 + x - 12$ by $x - 2$ using synthetic division.

# Extended Synthetic Division

1. Divide $2x^4 + 4x^3 - 5x^2 + 3x - 2$ by $x^2 + 2x - 3$

2. Divide $x^4 + 3x^2 + 1$ by $x^2 - 2x + 3$.

**You Try!** Divide $3x^3 - 5x^2 + 6x + 10$ by $x^2 + x + 2$