CHAPTER 0
REVIEW OF ALGEBRA
04. Operations with Algebraic Expressions

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1 Summary

Algebraic expressions with exactly 1 term are called **monomials**.

$$3x^2$$

Algebraic expressions with exactly 2 terms are called **binomials**.

$$3x^2 + 3x$$

Algebraic expressions with exactly 3 terms are called **trinomials**.

$$3x^2 + 3x + z$$

Algebraic expressions with more terms are called **polynomials**.

$$3x^2 + 3x + z + 6 + b^3$$

Special Products

1. $x(y + z) = xy + xz$
2. $(x + a)(x + b) = x^2 + x(a + b) + ab$
3. $(ax + c)(bx + d) = abx^2 + x(ad + bc) + cd$
4. $(x + a)^2 = x^2 + 2ax + a^2$
5. $(x - a)^2 = x^2 - 2ax + a^2$
6. $(x + a)(x - a) = x^2 - a^2$
7. $(x + a)^3 = x^3 + 3ax^2 + 3a^2x + a^3$
8. $(x - a)^3 = x^3 - 3ax^2 + 3a^2x - a^3$

2 Long Division

Divide $2x^3 - 14x - 5$ by $x - 3$

$$
\begin{array}{r|l}
 & 2x^2 + 6x + 4 \ \leftarrow Quotient \\
\hline
Divisor \rightarrow (x-3)\big) & 2x^3 + 0x^2 - 14x - 5 \\
 & -(2x^3 - 6x^2) \\
\hline
 & \quad 6x^2 - 14x \\
 & -(6x^2 - 18x) \\
\hline
 & \qquad 4x - 5 \\
 & -(4x - 12) \\
\hline
 & \qquad\quad 7 \ \leftarrow Remainder
\end{array}
$$

So the result of $2x^3 - 14x - 5$ by $x - 3$ is

$$2x^2 + 6x + 4 + \frac{7}{x-3}$$

- $\frac{Dividend}{Divisor} = Quotient + \frac{Remainder}{Divisor}$

A way of checking a division is to verify that

- $Dividend = \left(Quotient + \frac{Remainder}{Divisor}\right) Divisor$
- $Dividend = Quotient \cdot Divisor + \frac{Remainder}{Divisor} \cdot Divisor$
- $Dividend = Quotient \cdot Divisor + \frac{Remainder}{\cancel{Divisor}} \cdot \cancel{Divisor}$
- $Dividend = Quotient \cdot Divisor + Remainder$

By using this equation, you should be able to verify the result of the example.