

Warm Up

$$(a-b)(a+b) = a^2 - b^2$$

Simplify completely.

1. $(5x-1)(5x+1) = 25x^2 - 1$

2. $(3-\sqrt{2})(3+\sqrt{2})$

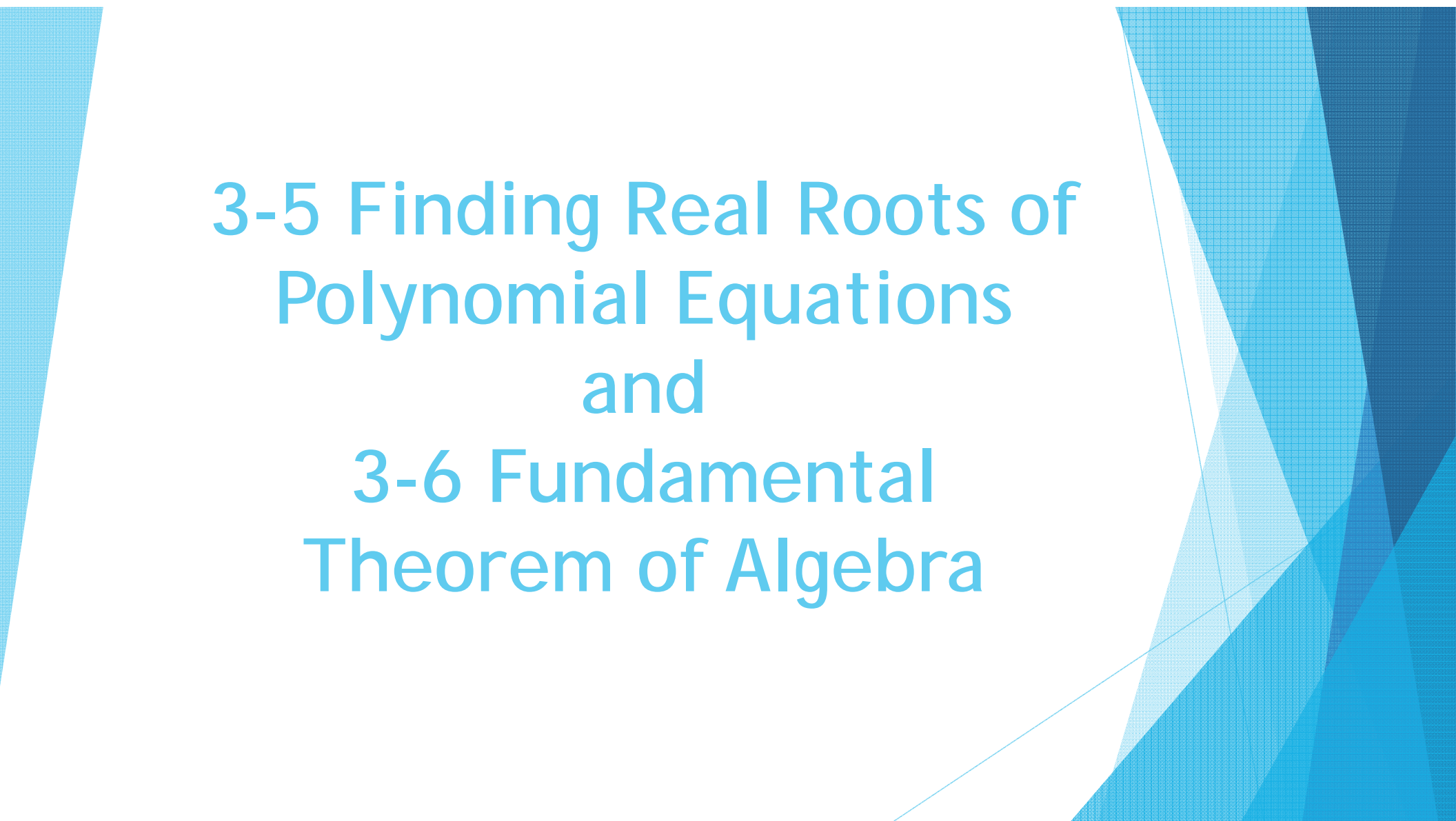
7

9-2

3. $(8+3i)(8-3i)$

73

$64 - 9i^2$
 $64 + 9$



3-5 Finding Real Roots of
Polynomial Equations
and
3-6 Fundamental
Theorem of Algebra

Formulas

Rectangular
Prism

$$V = lwh$$

Right Triangle
Pyramid

$$V = \frac{1}{3}lwh$$

Cone $V = \frac{1}{3}\pi r^2 h$

Sphere $V = \frac{4}{3}\pi r^3$

hemisphere

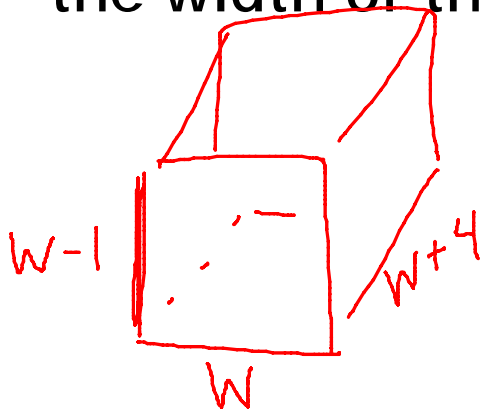
$$V = \frac{2}{3}\pi r^3$$

Cylinder $V = \pi r^2 h$

Applications

#1

The design of a box specifies that its length is 4 inches greater than its width. The height is 1 inch less than the width. The volume of the box is 12 cubic inches. What is the width of the box?



$$V = 12 \text{ in}^3$$

$$V = lwh$$

$$W(W+4)(W-1) = 12$$

$$W(W^2 + 3W - 4) = 12$$

$$W^3 + 3W^2 - 4W - 12 = 0$$

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

$$(W+3)(W+2)(W-2) = 0$$

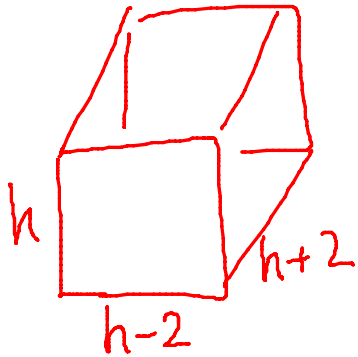
$$W = -3, -2, 2$$

width = 2 inches

Applications

#2

A shipping crate must hold 15 cubic feet. The length should be 2 feet longer than the height, and the width should be 2 feet less than the height. What should the height of the crate be? 3 feet



$$h(h-2)(h+2) = 15$$

$$h(h^2 - 4) = 15$$

$$h^3 - 4h - 15 = 0$$

$$\begin{array}{r|rrrr} 3 & 1 & 0 & -4 & -15 \\ & & 3 & 9 & 15 \\ \hline & 1 & 3 & 5 & 0 \end{array}$$

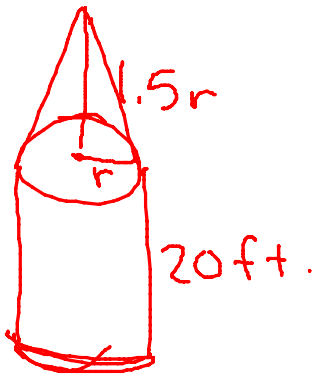
$$h^2 + 3h + 5 = 0$$

$$\begin{array}{l} b^2 - 4ac \\ 9 - 4(1)(5) \leq 0 \end{array}$$

Applications

#3

A silo is in the shape of a cylinder with a cone-shaped top. The cylinder is 20 feet tall. The height of the cone is 1.5 times the radius. The volume of the silo is 828π cubic feet. Find the radius of the silo.



$$V_{\text{SILLO}} = 828\pi \text{ ft}^3$$

$$V_{\text{SILLO}} = \overset{V_{\text{cylinder}}}{\pi r^2 h} + \overset{V_{\text{cone}}}{\frac{1}{3}\pi r^2 h}$$

$$828\pi = \pi r^2(20) + \frac{1}{3}\pi r^2(1.5r)$$

$$828 = 20r^2 + \frac{1}{2}r^3$$

$$\frac{1}{2}r^3 + 20r^2 - 828 = 0$$

$$\frac{1}{3} \cdot \frac{3}{2}$$

#3
cont.

$$r = 6 \text{ feet}$$

$$\begin{array}{r|rrrr} 6 & \frac{1}{2} & \cancel{20} & 0 & -828 \\ & & 3 & 138 & 828 \\ \hline & \frac{1}{2} & 23 & 138 & 0 \end{array}$$

$$\frac{1}{2}x^2 + 23x + 138 = 0 \leftarrow$$

solutions
are
negative

Applications

#4

A grain silo is in the shape of a cylinder with a hemisphere top. The cylinder is 20 feet tall. The volume of the silo is 2106π cubic feet. Find the radius of the silo.

$$r = 9 \text{ feet}$$

$$V_{\text{SILO}} = V_{\text{CYLINDER}} + V_{\text{HEMISPHERE}}$$

$$2106\pi = 20\pi r^2 + \frac{2}{3}\pi r^3$$

$$\frac{2}{3}r^3 + 20r^2 - 2106 = 0$$

$$\begin{array}{r|rrrr} 9 & \frac{2}{3} & 20 & 0 & -2106 \\ & & 6 & 234 & 2106 \\ \hline & \frac{2}{3} & 26 & 234 & 0 \end{array}$$

$$\frac{2}{3}r^2 + 26r + 234 = 0$$

↑
Solutions
don't
make
sense

$$(a+b)(a-b) = a^2 - b^2$$

Writing a Polynomial Function

Write the simplest polynomial function with zero $2 + i$

$$\textcircled{5} \quad \underline{f(x)} = [x - (2+i)][x - (2-i)]$$

$$f(x) = ((x-2) - i)((x-2) + i)$$

$$f(x) = (x-2)^2 - i^2$$

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

$$\boxed{f(x) = x^2 - 4x + 5}$$

Writing a Polynomial Function

Write the simplest polynomial function with zeros $2 + i$ and 1 .

$$\textcircled{6} \quad f(x) = x^3 - 5x^2 + 9x - 5$$

$$\textcircled{7} \quad f(x) = x^5 - 5x^4 + 6x^3 + 10x^2 - 27x + 15$$

$$\textcircled{8} \quad f(x) = x^6 - 2x^5 - 2x^3 - 13x^2 + 24x + 12$$

Writing a Polynomial Function

Write the simplest polynomial function with zeros $2 + i$, $\sqrt{3}$, and 1 .

Write the simplest polynomial function with zeros $2i$, $1 + \sqrt{2}$, and 3 .