MATH1034OL1 Pre-Calculus Mathematics Notes from Sections 4.8, 3.3 (Monday)

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Contents

1	Inverse Trigonometric Functions	1
2	Polynomial Long Division	3
3	Remainder Theroem	3
4	Descarte's Rule of Signs	4
5		Δ

1 Inverse Trigonometric Functions

The three inverse trigonometric functions are arccos, arcsin, and arctan. These functions have the property

$$arccos(x) = A$$

 $cos(A) = x$

In other words, cos and arccos are inverses of each other. They're helpful for determining an angle given its sin, cos, or tan value.

When we're finding $\arcsin(x)$, we restrict the range of arcsin such that it remains a function (that is, there are no two outputs $\arcsin(x)$ for one input x). We do this for all inverse

trigonometric functions. Here are the restrictions:

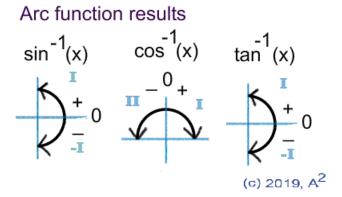


Figure 1: Credit: https://www.mathnstuff.com/math/spoken/here/2class/330/arc.htm

Problem: Find the Exact value of $sec\{arctan[sin(arccos(\frac{-1}{2}))]\}$.

First, recall that $\arccos(\frac{-1}{2})$ will be the angle whose cosine value is $\frac{-1}{2}$. We know this angle is $\frac{2\pi}{3}$ using the rules above.

Next, we determine that $\sin(\frac{2\pi}{3}) = \frac{\sqrt{3}}{2}$. This is where things get a little more complicated. $\arctan(\frac{\sqrt{3}}{2})$ isn't an angle with reference angle 30°, 45°, 60°, 90°. This is fine because, when we zoom out, we're asked to find $\sec(\arctan(\frac{\sqrt{3}}{2}))$. We know that the triangle formed by the angle $\arctan(\frac{\sqrt{3}}{2})$ has opp = $\sqrt{3}$ and $\operatorname{adj} = 2$. We use the pythagorean theorem to find the hypotenuse:

$$(\sqrt{3})^2 + 2^2 = c^2$$

$$\implies c = \sqrt{3+4} = \sqrt{7}$$

Hence, hyp = $\sqrt{7}$. Even though the angle $\arctan(\frac{\sqrt{3}}{2})$ doesn't form a special triangle, we can still find its sec value using the sides of the triangle it forms:

$$\sec\left(\arctan\left(\frac{\sqrt{3}}{2}\right)\right) = \frac{\text{hyp}}{\text{adj}} = \frac{\sqrt{7}}{2}$$

Knowing this, $\operatorname{sec}\{\arctan[\sin(\arccos(\frac{-1}{2}))]\} = \frac{\sqrt{7}}{2}$.

2 Polynomial Long Division

Polynomial division isn't easily explained in notes, but it's very important!. Here is my recommended resource for polynomial division:

https://www.mathsisfun.com/algebra/polynomials-division-long.html

3 Remainder Theroem

Remainder Theorem Formula When p(x) is divided by (x - a)Remainder = p(a)OR When p(x) is divided by p(ax + b)Remainder = p(a)

Figure 2: Credit: https://www.cuemath.com/algebra/remainder-theorem/

Descarte's Rule of Signs

Descartes' Rule of Signs



Number of positive real roots of f(x)

= Number of sign changes of f(x)(OR)

< Number of sign changes of f(x) by even number

Number of negative real roots of f(x)

= Number of sign changes of f(-x)(OR)

< Number of sign changes of f(-x) by even number

Figure 3: Credit: https://www.cuemath.com/algebra/descartes-rule-of-signs/

Descartes' Rule of Signs $+x^{5}-2x^{4}-3x^{3}+4x^{2}-x-1$ 3 changes \rightarrow 3 or 1 positive real solutions $(-x)^{5} - 2(-x)^{4} - 3(-x)^{3} + 4(-x)^{2} - (-x) - 1$ $-x^{5} - 2x^{4} + 3x^{3} + 4x^{2} + x - 1$ 2 changes \rightarrow 2 or 0 negative real solutions

Figure 4: Credit: https://andymath.com/descartes-rule-of-signs/