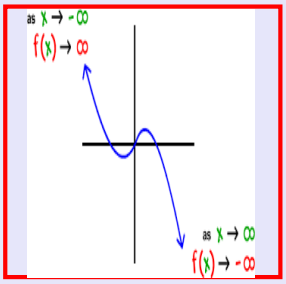
Math 245

Spring 2022

Lecture 39



Let $S(x) = (x-2)(x+3)(x-5)$

1) Y-Int $\to$ $x=0$ $\to$ $S(0) = (0-2)(0+3)(0-5)$

$= -2(3)(-5)$

$= 30$ Y-Int $(0,30)$

2) X-Int $\to$ $y=0$ $\to$ $S(x)=0$

$(x-2)(x+3)(x-5)=0$

$x-2=0$ $\quad$ $x+3=0$ $\quad$ $x-5=0$

$x=2$ $\quad$ $x=-3$ $\quad$ $x=5$

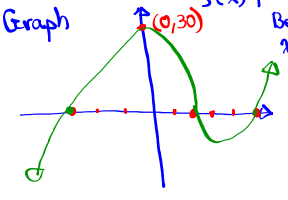
X-Ints: $(2,0), (-3,0), (5,0)$

3) Sign chart

x	$-\infty$		-3		2		5		∞
$x+3$		$-$	0	$+$		$+$		$+$	
$x-2$		$-$		$-$	0	$+$		$+$	
$x-5$		$-$		$-$		$-$	0	$+$	
$S(x)$		$-$		$+$		$-$		$+$	
		Below x-axis		Above x-axis		Below x-axis		Above x-axis	

Rough

4) Graph



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

1) Y-Int $\rightarrow x = 0 \rightarrow f(0) = (0+4)(0-1)^2 = 4(-1)^2 = 4 \cdot 1 = 4$

Y-Int $(0,4)$

2) X-Ints $\rightarrow y = 0 \rightarrow f(x) = 0 \rightarrow (x+4)(x-1)^2 = 0$

$x+4=0 \rightarrow x=-4$

$(x-1)^2 = 0 \rightarrow x-1=0 \rightarrow x=1$ Twice

X-Ints: $(-4,0)$, $(1,0)$ Twice

3) Sign chart

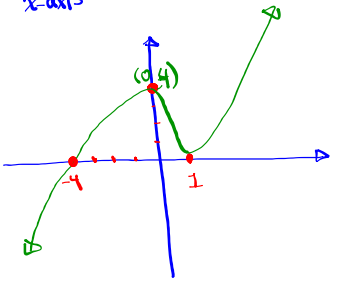
x	$-\infty$	-4	1	∞
$x+4$	$-$	$+$	$+$	
$(x-1)^2$	$+$	$+$	$+$	
$f(x)$	$-$ Below x-axis	$+$	$+$ Above x-axis	

4) Rough graph

when x-Int repeats

a) even # of times
Touch x-axis

b) odd # of times
Cut through x-axis



Consider $f(x) = (x+2)^2(x-2)^2$

1) Y-Int: $x = 0 \rightarrow f(0) = (0+2)^2(0-2)^2 = 4 \cdot 4 = 16$

$(0,16)$

2) X-Int: $y = 0 \rightarrow f(x) = 0 \rightarrow (x+2)^2(x-2)^2 = 0$

$x+2=0 \rightarrow x=-2$ Twice even

$x-2=0 \rightarrow x=2$ Twice even

$(2,0)$ Twice
$(-2,0)$ Twice
even # of times

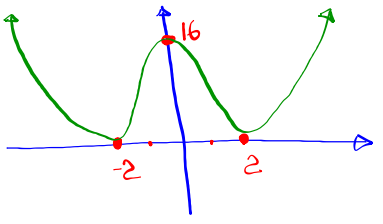
Touch x-axis

3) Sign chart

x	$-\infty$	-2	2	∞
$(x+2)^2$	$+$	$+$	$+$	
$(x-2)^2$	$+$	$+$	$+$	
$f(x)$	$+$	$+$	$+$	

above x-axis

4) Rough graph



$f(x) = (x-1)^4 (x+1)^3$

Y-Int $(0, 1)$

X-Int: $(1,0)$ → 4 times (even) — Touch

$(-1,0)$ → 3 times (odd) — Cut

x	$-\infty$	-1	1	∞
$(x+1)^3$	$-$	0	$+$	$+$
$(x-1)^4$	$+$	$+$	0	$+$
$f(x)$	$-$ Below		$+$ Above	$+$ Above

Rough Graph