36. $1 + 3i$ is a zero of $f(x) = x^4 - 2x^3 + 5x^2 + 10x - 50$.

Also

$1-3i$	1	-2	5	10	-50
	↓	$1-3i$	-10	$-5+15i$	50
Deg 3	1	$-1-3i$	-5	$5+15i$	0

$1+3i$	1	$-1-3i$	-5	$5+15i$
	↓	$1+3i$	0	$-5-15i$
Deg 2	1	0	-5	0

$x^2 - 5$

UB

4	1	-2	5	10	-50
	↓	4	8	52	Bigt
	1	2	13	62	$+$

UB #ckng ≥ 0

Last line must add +

LB #ckng < 0

Last sign alt. + neg

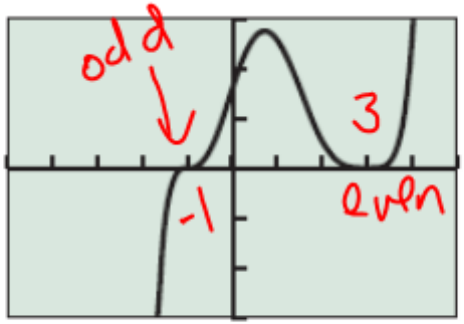
.....

$a^3 - b^3 \Rightarrow (a-b)(a^2+ab+b^2)$

$x^3 - 1 \qquad (x-1)(x^2+x+1)$

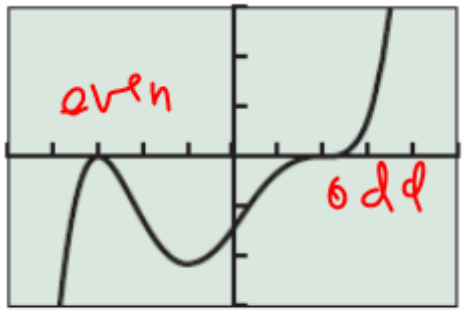
$a = x$

$b = 1$



[–5, 5] by [–150, 150]

(a)

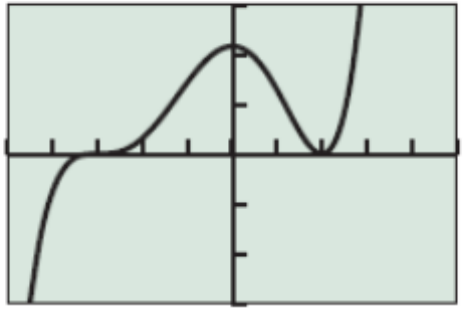


[–5, 5] by [–150, 150]

(b)

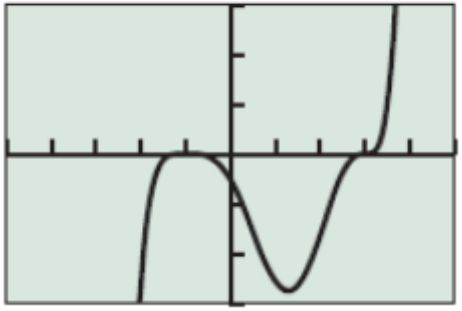
$(x+3)^{even}(x-2)^{odd}$

$(x+1)(x-3)$



[–5, 5] by [–150, 150]

(c)



[–5, 5] by [–150, 150]

(d)

17. -3 (multiplicity 2), 2 (multiplicity 3) (b)

18. -3 (multiplicity 3), 2 (multiplicity 2) (c)

19. -1 (multiplicity 4), 3 (multiplicity 3) (d)

20. -1 (multiplicity 3), 3 (multiplicity 4) (a)

30. $f(x) = 3x^4 + 8x^3 + 6x^2 + 3x - 2$

$\frac{\pm 1, \pm 2}{\pm 1 \ \pm 3} \Rightarrow \pm 1, \pm\frac{1}{3}, \pm 2, \pm\frac{2}{3}$

$f(-2) = 0$

$f(\frac{1}{3}) = 0$

$\frac{1}{3}$ | 3 8 6 3 −2

↓ 1 3 3 2

Deg 3 | 3 9 9 6 | 0

−2 | 3 9 9 6

↓ −6 −6 −6

Deg 2 | 3 3 3 | 0

Zeros

$\frac{1}{3}, -2, \frac{-1+\sqrt{3}i}{2}, \frac{-1-\sqrt{3}i}{2}$

$\sqrt{-27} = \sqrt{9 \cdot 3 \cdot -1}$

$3x^2 + 3x + 3 = 0$

$\frac{-3 \pm \sqrt{9 - 4(3)(3)}}{6} = \frac{-3 \pm \sqrt{-27}}{6}$

$\frac{-3 \pm 3i\sqrt{3}}{6} = \frac{-1 \pm i\sqrt{3}}{2}$

#27 $f(x) = x^3 + 4x - 5$

PRZ: $\pm 1 \quad \pm 5$

$f(1) = 0$

$(x-1)\left(x-\left(\frac{-1+i\sqrt{19}}{2}\right)\right)$

$\left(x-\left(\frac{-1-\sqrt{19}}{2}\right)\right)$

1 | 1 0 4 −5

	1	1	5
1	1	5	0

$x^2 + x + 5$

$\frac{-1 \pm \sqrt{1-4(1)(5)}}{2} = \frac{-1 \pm \sqrt{-19}}{2}$

$= \frac{-1 \pm i\sqrt{19}}{2}$