# 8.5 Polynomial Graphs

① $-x^{3}+3x-7$

Degree: 3 $\lim_{x\to-\infty} \infty$ $\lim_{x\to\infty} -\infty$

odd
-L.C. ↖ ↘

② $-x^{1}(x-3)^{3}(x-2)^{1}(x+1)^{4}$

1+3+1+4 = 9

Degree: 9 $\lim_{x\to-\infty} \infty$ $\lim_{x\to\infty} -\infty$

odd
-L.C. ↖ ↘

③ $(x-2)^{1}(x+7)^{3}$

1+3

Degree: 4 $\lim_{x\to-\infty} \infty$ $\lim_{x\to\infty} \infty$

even
+L.C. ↖ ↗

④ $2x^{4}-3x^{3}+2x-5$

Degree: 4 $\lim_{x\to-\infty} \infty$ $\lim_{x\to\infty} \infty$

even
+L.C. ↖ ↗

⑤ $P(x)=x(x+2)(x-2)$

zeros @ 0, -2, 2

odd
+LC ↙ ↗

$\boxed{\text{III}}$

⑥ $Q(x)=-x^{2}(x+2)(x-2)$

zeros @ 0, -2, 2
touch

even
-LC ↙ ↘

$\boxed{\text{I}}$

⑦ $R(x)=-x(x+1)(x-1)(x+2)(x-2)$

zeros 0, -1, 1, -2, 2

$\boxed{\text{V}}$

⑧ $S(x)=\frac{1}{4}x^{4}(x+2)(x-2)$

zeros @ 0, -2, 2
touch

even
+LC ↖ ↗

$\boxed{\text{II}}$

⑨ $T(x)=x^{3}(x+2)$

zeros @ 0, -2
wiggle

even
+LC ↖ ↗

$\boxed{\text{VI}}$

⑩ $U(x)=-x^{2}(x+2)$

zeros 0, -2
touch

odd
-LC

$\boxed{\text{IV}}$

⑪ $P(x)=x^{3}-x^{2}-6x$

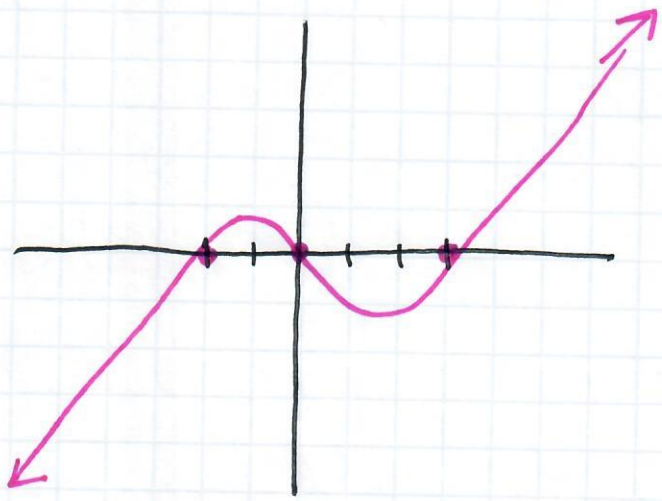
-6
-3 2
-1

$x(x^{2}-x-6)$
$x(x-3)(x+2)$

| zeros: | 0 | 3 | -2 |
|---|---|---|---|
| multiplicity: | 1 | 1 | 1 |
| | cross | cross | cross |

odd
+LC ↗ ↙

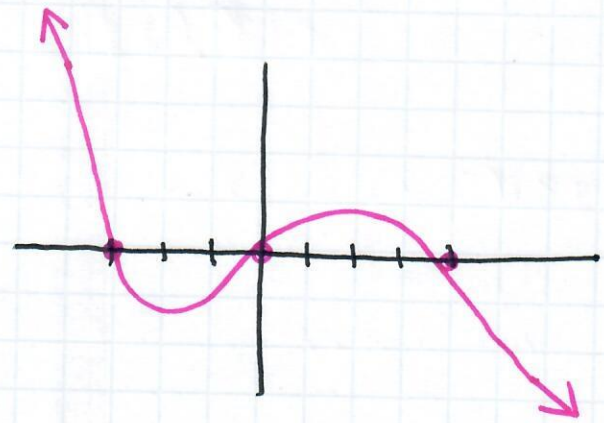
y-int: (0, 0)



(12) $P(x) = -x^3 + x^2 + 12x$

$-12$
$-4 \quad 3$
$-1$

$-x(x^2 - x - 12)$
$-x(x-4)(x+3)$



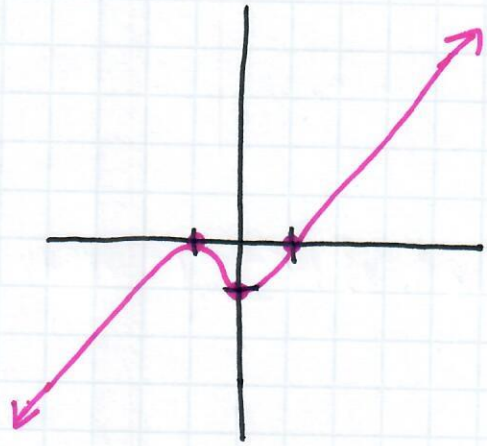
| zeros: | 0 | 4 | -3 |
|---|---|---|---|
| multiplicity: | 1 | 1 | 1 |
| | cross | cross | cross |

odd ↖ ↘
-LC

y-int (0,0)

(13) $P(x) = (x^3 + x^2)(-x - 1)$

$x^2(x+1) - 1(x+1)$
$(x+1)(x-1)(x+1)$
$(x+1)^2(x-1)$



| zeros: | -1 | 1 |
|---|---|---|
| multiplicity: | 2 | 1 |
| | touch | cross |

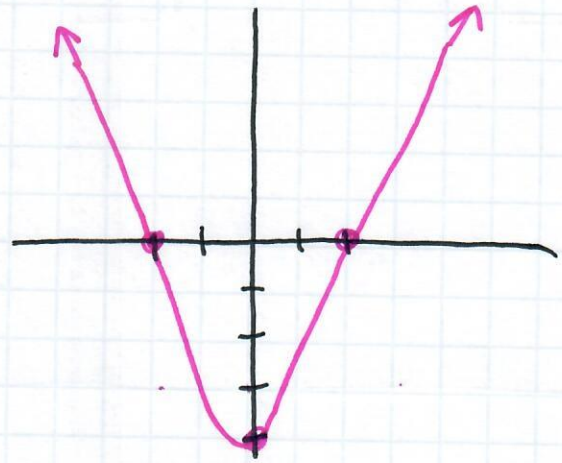
odd ↗ ↙
+LC

y-int (0,-1)

(14) $P(x) = x^4 - 3x^2 - 4$

$-4$
$-4 \quad 1$
$-3$

$(x^4 - 4x^2)(+1x^2 - 4)$
$x^2(x^2-4) + 1(x^2-4)$
$(x^2-4)(x^2+1)$
$(x-2)(x+2)(x^2+1)$
↑ non-real zero



| zeros: | 2 | -2 |
|---|---|---|
| multiplicity: | 1 | 1 |
| | cross | cross |

even ↖ ↗
+LC

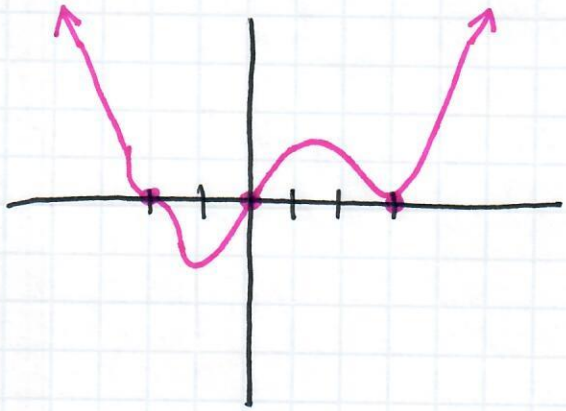
y-int (0,-4)

(15) $P(x) = x(x-3)^2(x+2)^3$

Already factored ☺

| zeros: | 0 | 3 | -2 |
|---|---|---|---|
| multiplicity: | 1 | 2 | 3 |
| | cross | touch | wiggle |

degree: 6 even ↖ ↗
+LC
y-int (0,0)



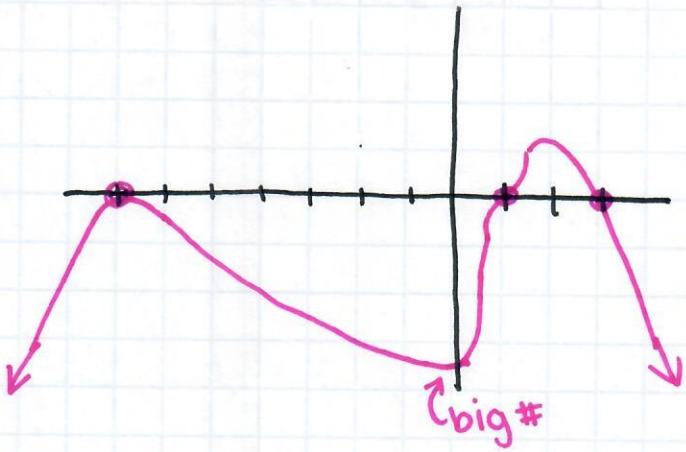
(16) $P(x) = -(x-1)^3(x+7)^4(x-3)$

Already factored

| zeros: | 1 | -7 | 3 |
|---|---|---|---|
| multiplicity: | 3 | 4 | 1 |
| | wiggle | touch | cross |

degree: 8 even
-LC ↙ ↘

yint (0, −)

$-1(0-1)^3(0+7)^4(0-3)$
$-1(-1)(7^4)(-3)$

− big #