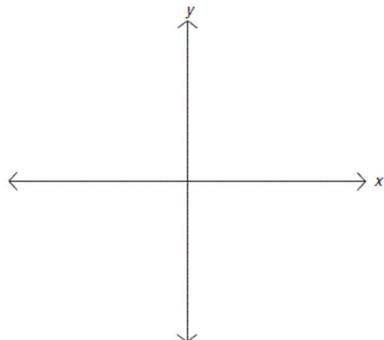


End Behavior and Multiplicities of Zeros

Sketch the general shape of each function and then describe the end behavior using **limit notation**.

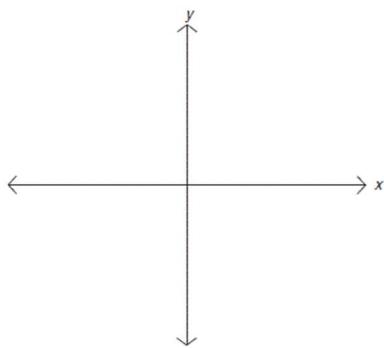
1. $f(x) = x^3 - 2x^2 - 2$



$$\lim_{x \rightarrow \infty} f(x) =$$

$$\lim_{x \rightarrow -\infty} f(x) =$$

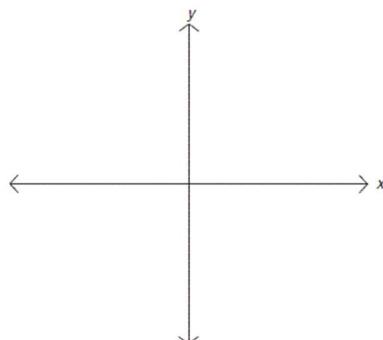
3. $f(x) = -x^5 + 3x^3 + 2x + 2$



$$\lim_{x \rightarrow \infty} f(x) =$$

$$\lim_{x \rightarrow -\infty} f(x) =$$

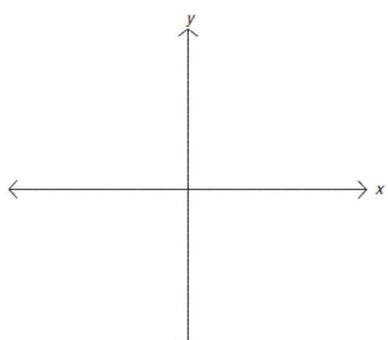
5. $f(x) = x^5 - 3x^3 + x + 3$



$$\lim_{x \rightarrow \infty} f(x) =$$

$$\lim_{x \rightarrow -\infty} f(x) =$$

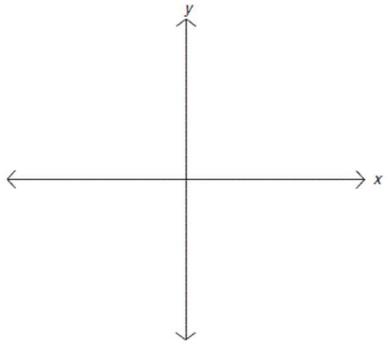
2. $f(x) = x^2 + 8x + 18$



$$\lim_{x \rightarrow \infty} f(x) =$$

$$\lim_{x \rightarrow -\infty} f(x) =$$

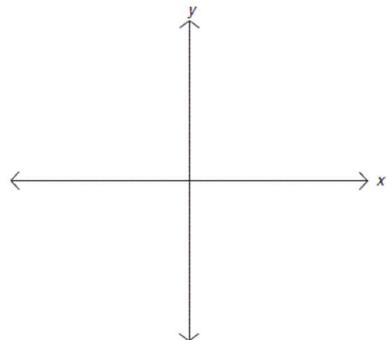
4. $f(x) = x^4 - 3x^2 + 3x$



$$\lim_{x \rightarrow \infty} f(x) =$$

$$\lim_{x \rightarrow -\infty} f(x) =$$

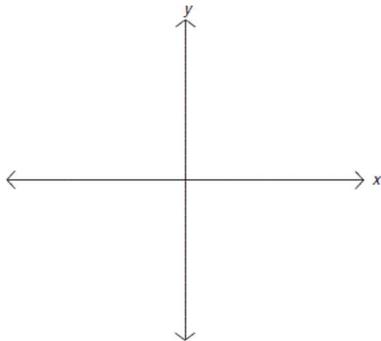
6. $f(x) = -x^3 + 4x^2 - 4$



$$\lim_{x \rightarrow \infty} f(x) =$$

$$\lim_{x \rightarrow -\infty} f(x) =$$

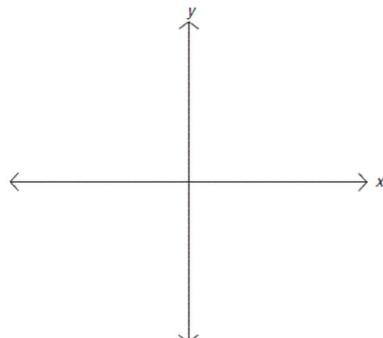
$$7. \quad f(x) = -x^4 + 4x^3 - 4x^2 + x + 4$$



$$\lim_{x \rightarrow \infty} f(x) =$$

$$\lim_{x \rightarrow -\infty} f(x) =$$

$$8. \quad f(x) = -2x^2 - 16x - 27$$



$$\lim_{x \rightarrow \infty} f(x) =$$

$$\lim_{x \rightarrow -\infty} f(x) =$$

Without sketching, state the end behavior of each function using **limit notation**.

$$9. \quad f(x) = -x^5 + 4x^3 - 2x + 2$$

10. $f(x) = x^4 - x^2 + x + 4$

$$\lim_{x \rightarrow \infty} f(x) =$$

$$\lim_{x \rightarrow \infty} f(x) =$$

$$\lim_{x \rightarrow -\infty} f(x) =$$

$$\lim_{x \rightarrow -\infty} f(x) =$$

For each polynomial function, make a chart stating the zeros, multiplicities and whether they touch or cross the x-axis.

11. $f(x) = (x + 1)^4(x - 5)^3$

12. $f(x) = (x - 3)(x + 2)^2$

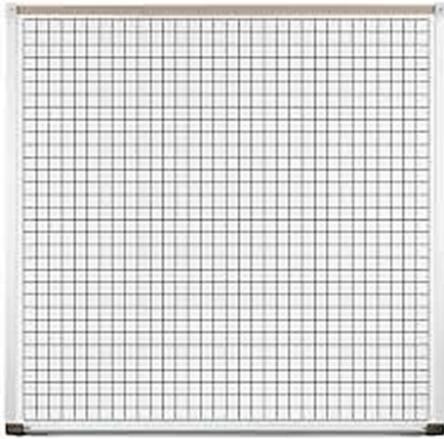
$$13. \ f(x) = (x^2 - 4)(x + 5)^3(x - 1)^2$$

14. $f(x) = (x - 1)^3(x^2 - 9)$

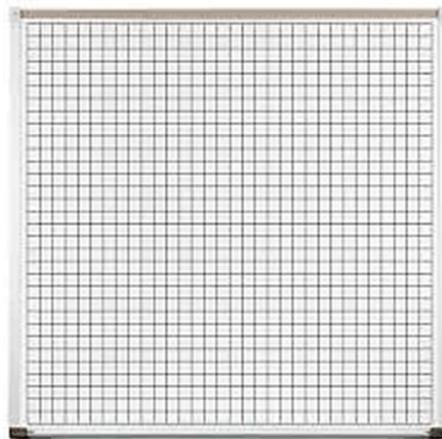
Without using technology, sketch each polynomial. Label the axes and points (zeros need to be labeled and placed correctly on the graph).

15. $f(x) = x^3 - 4x$

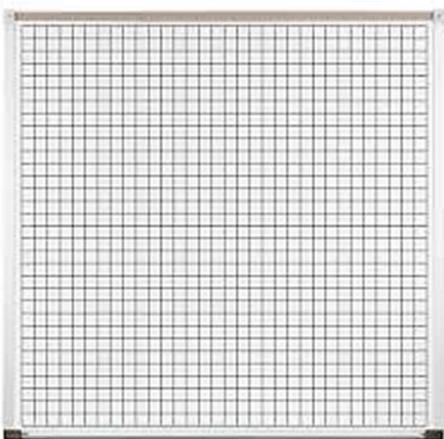
16. $f(x) = (x^2 - 4)(x^2 - 1)$



17. $f(x) = (x^2 - 1)(x^2 - 9)(x + 2)$

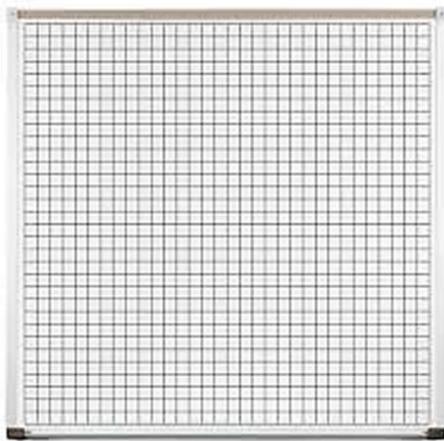


18. $f(x) = (x^2 - 1)(x^2 - 9)(x^2 - 4)$

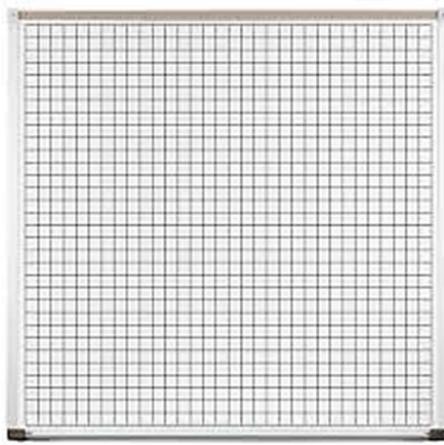


$$19. \ f(x) = (x - 4)^2(x + 2)$$

$$20. \ f(x) = (x - 3)^2(x + 5)^2(x - 1)$$



$$21. \ f(x) = (x + 2)^4(x - 1)^5$$



$$22. \ f(x) = (x - 4)^3(x + 1)^2$$

