

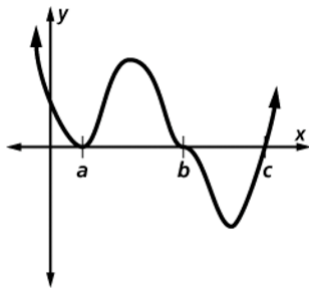
Let $f(x) = 6x^5 - 4x^3 + 3x^2 - 12x + 15$ and $g(x) = x^3 + 4x - 3$.

1. Find the quotient and remainder when $f(x)$ is divided by $g(x)$.
2. Find the quotient and remainder when $f(5)$ is divided by $g(5)$.

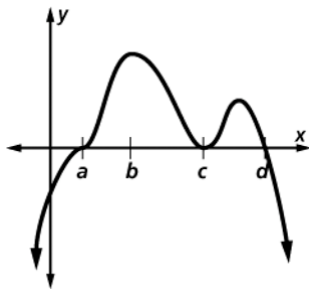
Let $f(x) = 4x^5 + 2x^4 - x^2 + 6x - 9$ and $g(x) = x^3 + 3x^2 - 4$.

3. Find the quotient and remainder when $f(x)$ is divided by $g(x)$.
4. Find the quotient and remainder when $f(2)$ is divided by $g(2)$.
5. Give the smallest possible integer solution to $k \equiv 36298 \pmod{17}$.
6. Give the smallest possible integer solution to $k \equiv 86282 \pmod{23}$.
7. Give the prime factorization of $3x^4 + 4x^3 - 27x^2 - 36x$ over the integers.
8. Give the prime factorization of $x^4 - 20x^2 + 64$ over the integers.
9. Use the fact that $(x \pm 5)$ is a factor of $f(x) = 4x^3 - 15x^2 - 31x + 30$ to find all the zeros of $f(x)$.
10. Use the fact that $(x + 1)$ is a factor of $f(x) = 2x^4 - 9x^3 + x^2 + 12x$ to find all the zeros of $f(x)$.
11. Is 1021 prime? If so, explain how you know. If not, write its standard prime factorization.
12. Is 2457 prime? If so, explain how you know. If not, write its standard prime factorization.
13. Given $A(x) = 2x^3 - 8$ and $B(x) = 10x^6 - 34x^3 - 24$, show that $A(x)$ is a factor of $B(x)$.

14. Given $A(x) = 5x^3 + 7x$ and $B(x) = 10x^5 - x^3 - 21x$, show that $A(x)$ is a factor of $B(x)$.
15. If $m \equiv 4 \pmod{9}$ and $n \equiv 7 \pmod{9}$, what is the remainder when $5m + n^2$ is divided by 9?
16. If $q \equiv 6 \pmod{11}$ and $r \equiv 2 \pmod{11}$, what is the remainder when $qr + 5r$ is divided by 11?
17. If $f(x) = 3x^4 - 10x^3 - 9x - 14$, use long division and the Remainder Theorem to find $f(4)$.
18. If $f(x) = x^4 - 4x^3 + 3x^2 - 12x - 10$, use long division and the Remainder Theorem to find $f(\pm 2)$.
19. The polynomial function f graphed below is of degree 6 and has a leading coefficient of 1. Write a possible polynomial $f(x)$ in factored form.



20. The polynomial function f graphed below is of degree 6 and has a leading coefficient of ± 1 . Write a possible polynomial $f(x)$ in factored form.



21. A polynomial $p(x)$ is divided by $2x^2 + 4x - 7$ to obtain a quotient $q(x)$ with a remainder $r(x)$. If $q(x)$ has a degree of 5, what is the degree of $p(x)$?

22. A polynomial $p(x)$ is divided by $4x^3 + 2x^2 - 5$ to obtain a quotient $q(x)$ with a remainder $r(x)$. If $p(x)$ has a degree of 7, what is the maximum possible degree of $r(x)$?
23. Use proof by contradiction to show that if n is a prime number, then $n + 1$ is not a prime number.
24. Use proof by contradiction to show that if n is a positive integer and n^2 is a multiple of 2, then n is a multiple of 2.

Joe and Jamal are going on a long road trip and agree to make a rest stop every 120 miles.

25. How many rest stops will they make by the time they drive 800 miles?
26. After driving 800 miles, Joe is hungry. How many more miles must he wait before the next rest stop?

Mrs. Jern made 400 muffins for a school bake sale. The muffins are packaged on plates by the dozen and sold for \$4 per plate.

27. How much money can the school make by selling all of the plates made up exclusively of muffins Mrs. Jern made?
28. How many more muffins would Mrs. Jern need to make so that her muffins could fill a whole number of plates?
29. Mr. Brown bought a refrigerator on a Wednesday at a store which requires that any returns be made within 90 days of purchase. What day of the week will be the last day Mr. Brown can return the refrigerator?
30. To raise money to fight world hunger, Danielle plans to participate in a 30-hour fast. She was instructed not to eat anything after noon on Friday. If she completes the fast, when will she be able to eat again?
31. Write the binary representation of $6D3_{16}$.
32. Write the binary representation of $A7A_{16}$.

33. Add $101101_2 + 11100_2$, giving your answer in base 2.

34. Add $11111_2 + 10111_2$, giving your answer in base 2.