

Synthetic Substitution

a) Use synthetic substitution to find the value of the function:

1. if $f(x) = x^3 - 6x^2 + 11x - 6$, determine $f(-3)$, $f(-1)$, $f(2)$, and $f(4)$
2. if $g(x) = 2x^5 - 3x^4 + 2x^2 - x + 8$, determine $g(-3)$, $g(-1)$, $g(3)$, and $g(5)$
3. if $P(x) = x^5 - 10x^4 + 20x^3 - 5x - 100$, determine $P(-4)$ and $P(6)$

1. -120, -24, 0, 6 2. -700, 6, 266, 4428 3. -4944, -994

b) Use synthetic substitution to determine whether or not the given factors are a factor of the given polynomial function.

1. $P(x) = 3x^4 - 11x^3 + 10x - 4$, $(x + 1)$ and $(3x - 2)$
2. $f(x) = x^3 + 6x^2 + x + 6$, $(x - 1)$ and $(x + 6)$
3. $g(x) = 5x^4 - 4x^3 + 19x^2 - 16x - 4$, $(x - 1)$ and $(x - 7)$
4. $h(x) = x^5 - 5x^4 + 5x^3 + 15x^2 - 36x + 20$, $(x + 1)$ and $(x + 2)$

1. yes, yes 2. no, yes
3. yes, no 4. no, yes

c) Use the Factor Theorem to determine the possible rational roots of the following polynomial functions.

1. $f(x) = x^4 + 2x^3 + 2x^2 - 4x - 8$
2. $P(x) = x^3 + 7x^2 + 4x + 28$
3. $g(x) = x^5 - 3x^2 + 1$
4. $h(x) = 3x^4 - 4x^3 + x^2 + 6x - 2$
5. $f(x) = 15x^6 + 47x^2 + 2$
6. $g(x) = 6x^3 + 12x^2 + 5x - 3$

1. $\pm 1, \pm 2, \pm 4, \pm 8$ 2. $\pm 1, \pm 2, \pm 4, \pm 7, \pm 14, \pm 28$
3. ± 1 4. $\pm 1, \pm 2, \pm \frac{1}{3}, \pm \frac{2}{3}$
5. $\pm 1, \pm 2, \pm \frac{1}{3}, \pm \frac{2}{3}, \pm \frac{1}{5}, \pm \frac{2}{5}, \pm \frac{1}{15}, \pm \frac{2}{15}$
6. $\pm 1, \pm 3, \pm \frac{1}{2}, \pm \frac{3}{2}, \pm \frac{1}{3}, \pm \frac{1}{6}$

d) Use the Factor Theorem and synthetic substitution to determine the roots of the following polynomial functions.

1. $f(x) = x^3 + 3x^2 - x - 3$
2. $g(x) = x^3 + 5x^2 - x - 5$
3. $h(x) = 2x^3 + 3x^2 + 2x + 3$
4. $P(x) = x^3 + 6x^2 + x + 6$
5. $f(x) = 3x^3 + 11x^2 - 2x + 8$
6. $g(x) = x^4 + x^3 - 13x^2 - x + 12$
7. $h(x) = 3x^4 - x^3 - 39x^2 - 23x + 12$

1. $(x - 1)(x + 1)(x + 3)$
2. $(x - 1)(x + 1)(x + 5)$
3. $(2x + 3)(x^2 + 1)$
4. $(x + 6)(x^2 + 1)$
5. $(x + 4)(3x^2 - x + 2)$
6. $(x - 1)(x + 1)(x - 3)(x + 4)$
7. $(3x - 1)(x + 1)(x + 3)(x - 4)$