

1. Find all zeros for $p(x) = x^3 + 5x^2 - 15x + 9$ if $x - 1$ is a factor. Provide exact answers only.

2. Find the remainder using long division. $(8x^3 + 3x - 10) \div (2x^2 - 5x + 1)$

6. Simplify. $6i^{17} + 4i^{12}$
- (A) $6 - 4i$ (B) $4 - 6i$ (C) $-6 + 4i$ (D) $4 + 6i$ (E) $-6 - 4i$
7. Simplify. $\frac{3 - i}{5i}$ Write your answer in $a + bi$ form.
- (A) $\frac{1}{5} + \frac{3}{5}i$ (B) $\frac{3}{5} + \frac{1}{5}i$ (C) $-\frac{1}{5} - \frac{3}{5}i$ (D) $-\frac{1}{2} + \frac{3}{2}i$ (E) $\frac{3}{5} - \frac{1}{5}i$
8. Solve the following: $x^2 = 4x - 8$
- (A) $1 \pm i$ (B) $-2 \pm 2i$ (C) $-1 \pm 2i$ (D) $2 \pm 2i$ (E) -5.5 and 1.5
9. Which of the following could not be a rational zero of $f(x) = 2x^3 + bx^2 + cx - 15$
- (A) -5 (B) $\frac{3}{2}$ (C) -1 (D) $\frac{1}{2}$ (E) $\frac{2}{5}$
10. Given the function $p(x) = -5x^2 + bx + c$ with vertex $(-3, 2)$, determine the range of the function.
- (A) $(-\infty, 2]$ (B) $[2, \infty)$ (C) $(-\infty, -3]$ (D) $[-3, \infty)$ (E) $(-2, \infty)$
11. The profit function, P , for a company selling n items is given by $P(n) = -3n^2 + 360n - 1500$. Determine the number of units that will produce a maximum profit.
- (A) 115 (B) 60 (C) 9300 (D) 360 (E) 120
12. Use synthetic division to find the quotient and remainder. $(x^3 - 2x^2 - 8) \div (x + 2)$
- (A) $Q(x) = x^2 + 4x - 8$
 $r(x) = 8$ (B) $Q(x) = x^3 - 4x^2 + 8$
 $r(x) = 24$ (C) $Q(x) = x^2 - 4x + 8$
 $r(x) = -24$
- (D) $Q(x) = x^2 - 4$
 $r(x) = 0$ (E) $Q(x) = x^2$
 $r(x) = -8$
13. Find all the zeros of $f(x) = -2x^4(x - 3)^2(2x + 3)^3$
- (A) $-2(m4), 3(m2), -\frac{3}{2}(m3)$ (B) $0(m4), -3(m2), \frac{3}{2}(m3)$ (C) $3(m2), -\frac{3}{2}(m3)$
- (D) $0(m4), 3(m2), -\frac{3}{2}(m3)$ (E) $-2(m4), 3(m2), -\frac{2}{3}(m3)$

14. Find a polynomial of lowest degree with real coefficients that has -5 and $3i$ as some of its zeros.
- (A) $x^3 - 5x^2 + 9x - 45$ (B) $x^3 + 5x^2 + 9x + 45$ (C) $x^2 + 5x - 3ix - 15$
 (D) $x^4 - 34x^2 - 225$ (E) $x^3 - 5x^2 - 9x + 45$
15. Write $p(x) = 2x^4 - 9x^3 - 3x^2 - 9x - 5$ as a product of linear factors.
- (A) $(x + 5)(2x + 1)(x + 1)(x - 1)$ (B) $(x - 3)(x + 2)(x - 2i)(x + 2i)$
 (C) $(x + 5)(x - 5)(x + 1)(x - 1)$ (D) $(x - 5)(2x - 1)(x + i)(x - i)$
 (E) $(x - 5)(2x + 1)(x + i)(x - i)$
16. Use synthetic division and the remainder theorem to determine the value of $p(i)$ for $p(x) = 3x^3 - 2x^2 + 5x + 4$
- (A) $6 + 2i$ (B) $2 + 8i$ (C) $2 + 6i$ (D) $-i$ (E) 0
17. Find the vertical asymptotes for $h(x) = \frac{(2x - 1)(x + 3)}{(x - 5)(3x - 2)}$
- (A) $x = \frac{1}{2}, x = -3$ (B) $x = \frac{1}{2}, x = -3, x = 5, x = \frac{2}{3}$ (C) $x = 5, x = \frac{2}{3}$
 (D) $x = -5, x = -\frac{2}{3}$ (E) there are no vertical asymptotes
18. Find the horizontal asymptotes for $g(x) = \frac{3x^2 + 2x - 16}{x^2 - 7}$.
- (A) $x = \pm \sqrt{7}$ (B) $y = 3$ (C) $y = \pm 7$ (D) $y = 0$ (E) there are no horizontal asymptotes
19. Solve $2x^2 + 3x - 5 < 0$
- (A) $(-2.5, 1)$ (B) $[-2.5, 1]$ (C) $[-2.5, \infty)$ (D) $(-\infty, -2.5) \cup (1, \infty)$ (E) $(-\infty, -1.5] \cup [5, \infty)$
20. Solve $\frac{2}{x + 1} \geq 5$
- (A) $\left(-\infty, -\frac{3}{5}\right]$ (B) $\left(-1, -\frac{3}{5}\right]$ (C) $(-\infty, -1) \cup \left[-\frac{3}{5}, \infty\right)$
 (D) $(-\infty, -1] \cup \left[-\frac{3}{5}, \infty\right)$ (E) $\left(-\infty, \frac{1}{5}\right]$

1. $x = 1, -3 \pm 3\sqrt{2}$

6. D

11. B

16. A

2. $49x - 20$

7. C

12. C

17. C

3. $k = -1$

8. D

13. D

18. B

4. $w = 300, L = 600$

9. E

14. B

19. A

5. $x = -\frac{3}{2}$

10. A

15. E

20. B

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6. D

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2. $49x - 20$

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15. E

20. B