1. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 10x^3 - 23x^2 - 88x + 80$$

A. $z_1 \in [-5, -3]$, $z_2 \in [-1.35, -1.06]$, and $z_3 \in [-0.2, 1.4]$

B. $z_1 \in [-0.4, 1.6]$, $z_2 \in [1.11, 1.3]$, and $z_3 \in [3.2, 4.7]$

C. $z_1 \in [-5, -3]$, $z_2 \in [-0.93, -0.79]$, and $z_3 \in [2, 3]$

D. $z_1 \in [-5, -3]$, $z_2 \in [-0.43, -0.09]$, and $z_3 \in [4.1, 5.5]$

E. $z_1 \in [-2.5, -1.5]$, $z_2 \in [0.6, 0.82]$, and $z_3 \in [3.2, 4.7]$

---

2. Factor the polynomial below completely, knowing that $x+5$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 6x^4 + 13x^3 - 144x^2 - 325x - 150$$

A. $z_1 \in [-5, -4]$, $z_2 \in [0.56, 0.73]$, $z_3 \in [-0.3, 2.1]$, and $z_4 \in [5, 7]$

B. $z_1 \in [-5, -4]$, $z_2 \in [-1.55, -1.48]$, $z_3 \in [-2.7, -0.6]$, and $z_4 \in [5, 7]$

C. $z_1 \in [-5, -4]$, $z_2 \in [0.56, 0.73]$, $z_3 \in [-0.3, 2.1]$, and $z_4 \in [5, 7]$

D. $z_1 \in [-5, -4]$, $z_2 \in [0.21, 0.5]$, $z_3 \in [2.8, 3.9]$, and $z_4 \in [5, 7]$

E. $z_1 \in [-5, -4]$, $z_2 \in [-1.55, -1.48]$, $z_3 \in [-2.7, -0.6]$, and $z_4 \in [5, 7]$

---

3. Factor the polynomial below completely, knowing that $x+5$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 15x^4 + 154x^3 + 461x^2 + 290x - 200$$

A. $z_1 \in [-3.21, -1.62]$, $z_2 \in [-0.5, 1]$, $z_3 \in [3, 4.3]$, and $z_4 \in [4, 6]$

B. $z_1 \in [-0.56, -0.26]$, $z_2 \in [0.9, 3], z_3 \in [3, 4.3]$, and $z_4 \in [4, 6]$

C. $z_1 \in [-5.03, -4.39]$, $z_2 \in [-4.5, -3.5], z_3 \in [-0.7, 0.1]$, and $z_4 \in [2.5, 4.5]$

D. $z_1 \in [-5.03, -4.39]$, $z_2 \in [-4.5, -3.5], z_3 \in [-2.5, -1.1]$, and $z_4 \in [0.4, 1.4]$

E. $z_1 \in [-0.27, 0.65]$, $z_2 \in [3.8, 4.1], z_3 \in [4.9, 5.5]$, and $z_4 \in [4, 6]$

---

4. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{15x^3 + 35x^2 - 15}{x + 2}$$

A. $a \in [12, 18], b \in [-13, -6], c \in [23, 32]$, and $r \in [-106, -103]$.

B. $a \in [-30, -27], b \in [-26, -21], c \in [-55, -49]$, and $r \in [-115, -112]$.

C. $a \in [12, 18], b \in [63, 67], c \in [124, 131]$, and $r \in [241, 248]$.

D. $a \in [-30, -27], b \in [92, 96], c \in [-191, -185]$, and $r \in [362, 368]$.

E. $a \in [12, 18], b \in [4, 10], c \in [-13, -5]$, and $r \in [4, 7]$.

---

5. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{12x^3 + 44x^2 + 4x - 57}{x + 3}$$

A. $a \in [-41, -27]$, $b \in [146, 153]$, $c \in [-456, -449]$, and $r \in [1295, 1303]$.

B. $a \in [10, 15]$, $b \in [-4, 5]$, $c \in [20, 21]$, and $r \in [-147, -136]$.

C. $a \in [10, 15]$, $b \in [79, 85]$, $c \in [239, 252]$, and $r \in [673, 676]$.

D. $a \in [-41, -27]$, $b \in [-65, -61]$, $c \in [-189, -186]$, and $r \in [-621, -617]$.

E. $a \in [10, 15]$, $b \in [8, 9]$, $c \in [-23, -15]$, and $r \in [-1, 6]$.

---

6. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 10x^3 + 47x^2 + 16x - 48$$

A. $z_1 \in [-0.5, -0.16]$, $z_2 \in [2.92, 3.62]$, and $z_3 \in [3.5, 4.58]$

B. $z_1 \in [-4.21, -3.82]$, $z_2 \in [-0.83, -0.6]$, and $z_3 \in [1.18, 1.38]$

C. $z_1 \in [-1.65, -0.91]$, $z_2 \in [0.19, 1.25]$, and $z_3 \in [3.5, 4.58]$

D. $z_1 \in [-4.21, -3.82]$, $z_2 \in [-1.76, -1.17]$, and $z_3 \in [0.53, 0.83]$

E. $z_1 \in [-0.82, -0.77]$, $z_2 \in [1.31, 1.88]$, and $z_3 \in [3.5, 4.58]$

---

7. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 6x^2 + 7x + 4$$

A. $\pm 1, \pm 2, \pm 3, \pm 6$

B. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 2, \pm 4}$

C. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 2, \pm 3, \pm 6}$

D. $\pm 1, \pm 2, \pm 4$

E. There is no formula or theorem that tells us all possible Rational roots.

---

8. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{8x^3 + 42x^2 - 53}{x + 5}$$

A. $a \in [-42, -37], b \in [-165, -155], c \in [-792, -788]$, and $r \in [-4006, -3999]$.

B. $a \in [8, 14], b \in [-7, -2], c \in [33, 37]$, and $r \in [-270, -265]$.

C. $a \in [-42, -37], b \in [242, 244], c \in [-1217, -1206]$, and $r \in [5996, 5999]$.

D. $a \in [8, 14], b \in [0, 6], c \in [-11, -4]$, and $r \in [-4, 2]$.

E. $a \in [8, 14], b \in [78, 85], c \in [404, 411]$, and $r \in [1995, 1999]$.

---

9. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{4x^3 - 4x^2 - 32x + 45}{x + 3}$$

A. $a \in [2, 7]$, $b \in [6, 14]$, $c \in [-9, -5]$, and $r \in [13, 24]$.

B. $a \in [2, 7]$, $b \in [-17, -8]$, $c \in [13, 18]$, and $r \in [-6, -1]$.

C. $a \in [2, 7]$, $b \in [-22, -19]$, $c \in [43, 50]$, and $r \in [-151, -144]$.

D. $a \in [-16, -6]$, $b \in [32, 35]$, $c \in [-128, -127]$, and $r \in [428, 432]$.

E. $a \in [-16, -6]$, $b \in [-45, -36]$, $c \in [-153, -146]$, and $r \in [-417, -404]$.

---

10. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 6x^2 + 5x + 5$$

A. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 2, \pm 3, \pm 6}$

B. $\pm 1, \pm 2, \pm 3, \pm 6$

C. $\pm 1, \pm 5$

D. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 5}$

E. There is no formula or theorem that tells us all possible Rational roots.
