1. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 5x^3 + 7x^2 + 5x + 2$$

A. $\pm 1, \pm 5$

B. $\pm 1, \pm 2$

C. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 2}$

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

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

---

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

$$\frac{20x^3 + 29x^2 - 81x + 31}{x + 3}$$

A. $a \in [14, 25]$, $b \in [-54, -49]$, $c \in [121, 126]$, and $r \in [-463, -460]$.

B. $a \in [14, 25]$, $b \in [78, 93]$, $c \in [185, 193]$, and $r \in [589, 590]$.

C. $a \in [-63, -58]$, $b \in [-155, -147]$, $c \in [-536, -531]$, and $r \in [-1575, -1568]$.

D. $a \in [-63, -58]$, $b \in [204, 212]$, $c \in [-714, -704]$, and $r \in [2152, 2156]$.

E. $a \in [14, 25]$, $b \in [-35, -29]$, $c \in [6, 16]$, and $r \in [-6, -1]$.

---

3. 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.*

$$f(x) = 15x^3 + 79x^2 + 82x + 24$$

A. $z_1 \in [1.36, 1.69]$, $z_2 \in [1.61, 1.89]$, and $z_3 \in [3.75, 4.1]$

B. $z_1 \in [-4.03, -3.6]$, $z_2 \in [-1.92, -1.22]$, and $z_3 \in [-1.51, -1]$

C. $z_1 \in [0.41, 0.72]$, $z_2 \in [0.31, 0.74]$, and $z_3 \in [3.75, 4.1]$

D. $z_1 \in [-0.12, 0.24]$, $z_2 \in [1.73, 2.38]$, and $z_3 \in [3.75, 4.1]$

E. $z_1 \in [-4.03, -3.6]$, $z_2 \in [-1.02, -0.07]$, and $z_3 \in [-0.98, -0.18]$

---

4. Factor the polynomial below completely, knowing that $x-4$ 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.*

$$f(x) = 25x^4 - 175x^3 + 356x^2 - 236x + 48$$

A. $z_1 \in [-5.1, -2.9]$, $z_2 \in [-3.21, -2.94]$, $z_3 \in [-2.25, -1.81]$, and $z_4 \in [-0.17, 0.28]$

B. $z_1 \in [1.3, 2.1]$, $z_2 \in [1.12, 2.02]$, $z_3 \in [2.2, 3.35]$, and $z_4 \in [3.14, 4.24]$

C. $z_1 \in [-5.1, -2.9]$, $z_2 \in [-2.49, -1.62]$, $z_3 \in [-0.69, -0.01]$, and $z_4 \in [-0.61, -0.26]$

D. $z_1 \in [-5.1, -2.9]$, $z_2 \in [-2.72, -2.43]$, $z_3 \in [-2.25, -1.81]$, and $z_4 \in [-2.25, -1.63]$

E. $z_1 \in [0.1, 0.8]$, $z_2 \in [0.28, 1.28]$, $z_3 \in [1.76, 2.02]$, and $z_4 \in [3.14, 4.24]$

---

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

$$\frac{12x^3 + 28x^2 - 14}{x + 2}$$

A. $a \in [-28, -19], b \in [67, 81], c \in [-153, -146]$, and $r \in [290, 293]$.

B. $a \in [9, 21], b \in [-8, -3], c \in [22, 33]$, and $r \in [-87, -83]$.

C. $a \in [9, 21], b \in [48, 56], c \in [104, 105]$, and $r \in [193, 196]$.

D. $a \in [-28, -19], b \in [-26, -18], c \in [-41, -33]$, and $r \in [-96, -90]$.

E. $a \in [9, 21], b \in [3, 8], c \in [-8, -1]$, and $r \in [-4, 6]$.

---

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.*

$$f(x) = 20x^3 + 121x^2 + 184x + 80$$

A. $z_1 \in [0.74, 1.49]$, $z_2 \in [1.25, 2.25]$, and $z_3 \in [3, 5]$

B. $z_1 \in [0.74, 1.49]$, $z_2 \in [1.25, 2.25]$, and $z_3 \in [3, 5]$

C. $z_1 \in [-4.53, -3.89]$, $z_2 \in [-2.25, 0.75]$, and $z_3 \in [-0.8, 2.2]$

D. $z_1 \in [-4.53, -3.89]$, $z_2 \in [-2.25, 0.75]$, and $z_3 \in [-0.8, 2.2]$

E. $z_1 \in [0.1, 0.49]$, $z_2 \in [4, 7]$, and $z_3 \in [3, 5]$

---

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

$$\frac{10x^3 + 85x^2 + 200x + 130}{x + 5}$$

A. $a \in [6, 11]$, $b \in [32, 39]$, $c \in [25, 28]$, and $r \in [5, 12]$.

B. $a \in [-52, -47]$, $b \in [-166, -161]$, $c \in [-629, -620]$, and $r \in [-2999, -2993]$.

C. $a \in [6, 11]$, $b \in [24, 29]$, $c \in [41, 55]$, and $r \in [-172, -162]$.

D. $a \in [-52, -47]$, $b \in [331, 340]$, $c \in [-1477, -1472]$, and $r \in [7503, 7507]$.

E. $a \in [6, 11]$, $b \in [132, 142]$, $c \in [867, 878]$, and $r \in [4503, 4509]$.

---

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

$$f(x) = 6x^4 + 7x^3 + 3x^2 + 6x + 3$$

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

B. $\pm 1, \pm 3$

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

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

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

---

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

$$\frac{20x^3 + 105x^2 - 120}{x + 5}$$

A. $a \in [-104, -91], b \in [603, 611], c \in [-3028, -3019]$, and $r \in [15003, 15007]$.

B. $a \in [20, 22], b \in [204, 210], c \in [1018, 1028]$, and $r \in [5000, 5011]$.

C. $a \in [20, 22], b \in [4, 7], c \in [-25, -23]$, and $r \in [2, 7]$.

D. $a \in [20, 22], b \in [-19, -12], c \in [85, 92]$, and $r \in [-662, -657]$.

E. $a \in [-104, -91], b \in [-403, -390], c \in [-1978, -1968]$, and $r \in [-9996, -9992]$.

---

10. 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.*

$$f(x) = 12x^4 - 19x^3 - 215x^2 - 25x + 375$$

A. $z_1 \in [-4.8, -2]$, $z_2 \in [-0.75, -0.48], z_3 \in [0.79, 1.02]$, and $z_4 \in [5, 8]$

B. $z_1 \in [-6.3, -4.2]$, $z_2 \in [-1.15, -0.71], z_3 \in [0.59, 0.65]$, and $z_4 \in [3, 4]$

C. $z_1 \in [-4.8, -2]$, $z_2 \in [-2.09, -1.49], z_3 \in [1.19, 1.37]$, and $z_4 \in [5, 8]$

D. $z_1 \in [-6.3, -4.2]$, $z_2 \in [-5.09, -4.63], z_3 \in [0.41, 0.46]$, and $z_4 \in [3, 4]$

E. $z_1 \in [-6.3, -4.2]$, $z_2 \in [-1.58, -1.01], z_3 \in [1.4, 1.78]$, and $z_4 \in [3, 4]$