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

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

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

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

   C. $\pm 1, \pm 2$

   D. All combinations of: $\dfrac{\pm 1, \pm 2}{\pm 1, \pm 2, \pm 4}$

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

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2. 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.*

$$f(x) = 25x^3 - 130x^2 + 13x + 60$$

   A. $z_1 \in [-5.9, -4.8]$, $z_2 \in [-4.78, -3.37]$, and $z_3 \in [-0.49, 0.26]$

   B. $z_1 \in [-1.1, 0.8]$, $z_2 \in [0.63, 1.01]$, and $z_3 \in [4.66, 5.1]$

   C. $z_1 \in [-5.9, -4.8]$, $z_2 \in [-1.14, -0.35]$, and $z_3 \in [0.38, 1.13]$

   D. $z_1 \in [-5.9, -4.8]$, $z_2 \in [-1.85, -1.24]$, and $z_3 \in [1.59, 1.95]$

   E. $z_1 \in [-2.9, -1.3]$, $z_2 \in [1.02, 1.57]$, and $z_3 \in [4.66, 5.1]$

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

$$\frac{6x^3 - 18x + 17}{x + 2}$$

   A. $a \in [-12, -6], b \in [-29, -20], c \in [-68, -62]$, and $r \in [-116, -114]$.

   B. $a \in [5, 11], b \in [-15, -10], c \in [5, 14]$, and $r \in [5, 14]$.

   C. $a \in [-12, -6], b \in [15, 29], c \in [-68, -62]$, and $r \in [146, 158]$.

D. $a \in [5, 11], b \in [11, 19], c \in [5, 14]$, and $r \in [28, 31]$.

E. $a \in [5, 11], b \in [-19, -17], c \in [31, 41]$, and $r \in [-94, -87]$.

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4. 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.*

$$f(x) = 20x^3 - 113x^2 + 142x - 40$$

A. $z_1 \in [-4.35, -3.54]$, $z_2 \in [-1.7, -0.8]$, and $z_3 \in [-0.68, -0.15]$

B. $z_1 \in [0.7, 1.11]$, $z_2 \in [1.4, 2.8]$, and $z_3 \in [3.76, 4.6]$

C. $z_1 \in [-4.35, -3.54]$, $z_2 \in [-3.1, -1.7]$, and $z_3 \in [-0.85, -0.5]$

D. $z_1 \in [-0.32, 0.75]$, $z_2 \in [1, 1.6]$, and $z_3 \in [3.76, 4.6]$

E. $z_1 \in [-5.12, -4.89]$, $z_2 \in [-5.3, -3.9]$, and $z_3 \in [-0.25, 0.34]$

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

$$\frac{6x^3 + 18x^2 - 26}{x + 2}$$

A. $a \in [-19, -10], b \in [41, 50], c \in [-85, -81]$, and $r \in [142, 144]$.

B. $a \in [-19, -10], b \in [-11, -4], c \in [-13, -6]$, and $r \in [-51, -49]$.

C. $a \in [3, 13], b \in [30, 31], c \in [52, 64]$, and $r \in [92, 97]$.

D. $a \in [3, 13], b \in [-3, 2], c \in [-3, 5]$, and $r \in [-26, -23]$.

E. $a \in [3, 13], b \in [2, 12], c \in [-13, -6]$, and $r \in [-8, 0]$.

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

$$\frac{12x^3 + 55x^2 + 18x - 43}{x + 4}$$

A. $a \in [-49, -43]$, $b \in [-137, -134]$, $c \in [-536, -529]$, and $r \in [-2165, -2159]$.

B. $a \in [10, 15]$, $b \in [103, 107]$, $c \in [426, 435]$, and $r \in [1677, 1679]$.

C. $a \in [-49, -43]$, $b \in [239, 248]$, $c \in [-975, -969]$, and $r \in [3835, 3842]$.

D. $a \in [10, 15]$, $b \in [5, 8]$, $c \in [-16, -3]$, and $r \in [-10, 2]$.

E. $a \in [10, 15]$, $b \in [-9, -4]$, $c \in [41, 45]$, and $r \in [-263, -257]$.

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

$$\frac{9x^3 + 18x^2 - 37x - 26}{x + 3}$$

A. $a \in [3, 16]$, $b \in [45, 51]$, $c \in [92, 101]$, and $r \in [262, 275]$.

B. $a \in [-32, -26]$, $b \in [97, 105]$, $c \in [-337, -333]$, and $r \in [975, 981]$.

C. $a \in [3, 16]$, $b \in [-13, -5]$, $c \in [-12, -7]$, and $r \in [-3, 8]$.

D. $a \in [3, 16]$, $b \in [-20, -14]$, $c \in [30, 36]$, and $r \in [-168, -163]$.

E. $a \in [-32, -26]$, $b \in [-63, -56]$, $c \in [-228, -223]$, and $r \in [-709, -702]$.

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8. Factor the polynomial below completely, knowing that $x - 3$ 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.*

$$f(x) = 16x^4 + 64x^3 - 161x^2 - 450x - 225$$

A. $z_1 \in [-3.6, -2.8]$, $z_2 \in [0.76, 0.89]$, $z_3 \in [1.29, 1.34]$, and $z_4 \in [4, 6]$

B. $z_1 \in [-3.6, -2.8]$, $z_2 \in [0.07, 0.25]$, $z_3 \in [4.99, 5.04]$, and $z_4 \in [4, 6]$

C. $z_1 \in [-3.6, -2.8]$, $z_2 \in [0.69, 0.79]$, $z_3 \in [1.17, 1.28]$, and $z_4 \in [4, 6]$

D. $z_1 \in [-5.5, -4.1]$, $z_2 \in [-1.34, -1.26]$, $z_3 \in [-0.82, -0.77]$, and $z_4 \in [0, 4]$

E. $z_1 \in [-5.5, -4.1]$, $z_2 \in [-1.25, -1.19]$, $z_3 \in [-0.78, -0.72]$, and $z_4 \in [0, 4]$

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9. 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.*

$$f(x) = 12x^4 + 101x^3 + 245x^2 + 212x + 60$$

A. $z_1 \in [0.53, 1.14]$, $z_2 \in [0.68, 1.03]$, $z_3 \in [1.13, 2.11]$, and $z_4 \in [4.3, 5.8]$

B. $z_1 \in [-5.56, -4.38]$, $z_2 \in [-2.09, -1.75]$, $z_3 \in [-1.59, -1.04]$, and $z_4 \in [-1.7, -1]$

C. $z_1 \in [-0.44, 0.45]$, $z_2 \in [1.71, 2.14]$, $z_3 \in [1.13, 2.11]$, and $z_4 \in [4.3, 5.8]$

D. $z_1 \in [1.08, 2.04]$, $z_2 \in [1.12, 1.66]$, $z_3 \in [1.13, 2.11]$, and $z_4 \in [4.3, 5.8]$

E. $z_1 \in [-5.56, -4.38]$, $z_2 \in [-2.09, -1.75]$, $z_3 \in [-0.76, 0.49]$, and $z_4 \in [-0.9, 0.7]$

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

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

A. $\pm 1, \pm 3$

B. $\pm 1, \pm 7$

C. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 7}$

D. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 3}$

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