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

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

A. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 2, \pm 3, \pm 6}$

B. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 7}$

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

D. $\pm 1, \pm 7$

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.*

$$f(x) = 15x^3 + 91x^2 + 84x + 20$$

A. $z_1 \in [0.07, 0.25]$, $z_2 \in [1.86, 2.35]$, and $z_3 \in [2, 7]$

B. $z_1 \in [-5.17, -4.99]$, $z_2 \in [-2.52, -2.48]$, and $z_3 \in [-1.5, -0.5]$

C. $z_1 \in [-5.17, -4.99]$, $z_2 \in [-1.06, -0.1]$, and $z_3 \in [-1.4, 1.6]$

D. $z_1 \in [1.27, 1.51]$, $z_2 \in [2.02, 3.25]$, and $z_3 \in [2, 7]$

E. $z_1 \in [0.32, 0.61]$, $z_2 \in [0.61, 1.51]$, and $z_3 \in [2, 7]$

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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.

$$\frac{10x^3 + 30x^2 - 35}{x + 2}$$

A. $a \in [-22, -18], b \in [68, 72], c \in [-144, -136]$, and $r \in [241, 251]$.

B. $a \in [-22, -18], b \in [-10, -6], c \in [-28, -18]$, and $r \in [-81, -72]$.

C. $a \in [2, 11], b \in [48, 55], c \in [98, 107]$, and $r \in [158, 170]$.

D. $a \in [2, 11], b \in [-1, 6], c \in [-2, 3]$, and $r \in [-37, -31]$.

E. $a \in [2, 11], b \in [4, 11], c \in [-28, -18]$, and $r \in [-1, 9]$.

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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.*

$$f(x) = 12x^3 + 35x^2 + 7x - 30$$

A. $z_1 \in [-2.03, -1.79]$, $z_2 \in [-2.18, -1.66]$, and $z_3 \in [0.5, 1.3]$

B. $z_1 \in [-0.9, -0.7]$, $z_2 \in [1.65, 1.76]$, and $z_3 \in [1.8, 3.1]$

C. $z_1 \in [-0.57, 0.04]$, $z_2 \in [1.99, 2.02]$, and $z_3 \in [4, 6]$

D. $z_1 \in [-2.03, -1.79]$, $z_2 \in [-0.82, -0.31]$, and $z_3 \in [1.3, 1.5]$

E. $z_1 \in [-1.75, -1.19]$, $z_2 \in [0.57, 0.61]$, and $z_3 \in [1.8, 3.1]$

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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.

$$\frac{6x^3 + 26x^2 - 30}{x + 4}$$

A. $a \in [4, 8], b \in [1, 8], c \in [-15, -6]$, and $r \in [-3, 6]$.

B. $a \in [4, 8], b \in [45, 55], c \in [198, 205]$, and $r \in [763, 774]$.

C. $a \in [4, 8], b \in [-6, 0], c \in [18, 25]$, and $r \in [-139, -127]$.

D. $a \in [-27, -23], b \in [-71, -64], c \in [-284, -277]$, and $r \in [-1154, -1149]$.

E. $a \in [-27, -23], b \in [118, 129], c \in [-490, -487]$, and $r \in [1922, 1924]$.

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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.

$$\frac{8x^3 - 18x^2 - 6x + 15}{x - 2}$$

A. $a \in [14, 17], \; b \in [13, 21], \; c \in [21, 26], \text{ and } r \in [57, 66].$

B. $a \in [7, 10], \; b \in [-4, 2], \; c \in [-15, -5], \text{ and } r \in [-6, -2].$

C. $a \in [7, 10], \; b \in [-38, -32], \; c \in [56, 66], \text{ and } r \in [-110, -108].$

D. $a \in [7, 10], \; b \in [-14, -6], \; c \in [-21, -14], \text{ and } r \in [-3, 6].$

E. $a \in [14, 17], \; b \in [-50, -46], \; c \in [89, 95], \text{ and } r \in [-179, -163].$

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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.

$$\frac{8x^3 - 22x^2 - 21x + 49}{x - 3}$$

A. $a \in [4, 14], \; b \in [-1, 3], \; c \in [-21, -13], \text{ and } r \in [3, 8].$

B. $a \in [4, 14], \; b \in [-6, 0], \; c \in [-33, -31], \text{ and } r \in [-17, -13].$

C. $a \in [21, 27], \; b \in [45, 52], \; c \in [127, 131], \text{ and } r \in [436, 443].$

D. $a \in [4, 14], \; b \in [-49, -45], \; c \in [117, 124], \text{ and } r \in [-302, -299].$

E. $a \in [21, 27], \; b \in [-98, -90], \; c \in [261, 269], \text{ and } r \in [-736, -730].$

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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.*

$$f(x) = 8x^4 - 22x^3 - 53x^2 + 205x - 150$$

A. $z_1 \in [-5.07, -4.81], \; z_2 \in [-2.23, -1.27], z_3 \in [-0.67, -0.55], \text{ and } z_4 \in [2.63, 3.42]$

B. $z_1 \in [-2.97, -2.29], \; z_2 \in [-2.23, -1.27], z_3 \in [-1.44, -1.1], \text{ and } z_4 \in [2.63, 3.42]$

C. $z_1 \in [-3.31, -2.85], \; z_2 \in [0.01, 0.55], z_3 \in [0.76, 0.85], \text{ and } z_4 \in [1.89, 2.33]$

D. $z_1 \in [-2.26, -0.67], \; z_2 \in [-0.89, -0.77], z_3 \in [-0.43, -0.2], \text{ and } z_4 \in [2.63, 3.42]$

E. $z_1 \in [-3.31, -2.85]$, $z_2 \in [1.13, 1.73]$, $z_3 \in [1.98, 2.07]$, and $z_4 \in [2.05, 2.5]$

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9. 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.*

$$f(x) = 15x^4 - 11x^3 - 318x^2 + 528x - 160$$

A. $z_1 \in [-4.68, -3.48]$, $z_2 \in [-2.64, -2.37]$, $z_3 \in [-0.83, -0.51]$, and $z_4 \in [4.59, 5.75]$

B. $z_1 \in [-4.68, -3.48]$, $z_2 \in [-4.04, -3.53]$, $z_3 \in [-0.25, -0.12]$, and $z_4 \in [4.59, 5.75]$

C. $z_1 \in [-5.34, -4.95]$, $z_2 \in [0.32, 0.69]$, $z_3 \in [1.29, 1.64]$, and $z_4 \in [3.28, 4.56]$

D. $z_1 \in [-4.68, -3.48]$, $z_2 \in [-1.54, -0.8]$, $z_3 \in [-0.59, -0.26]$, and $z_4 \in [4.59, 5.75]$

E. $z_1 \in [-5.34, -4.95]$, $z_2 \in [0.72, 1.26]$, $z_3 \in [2.04, 2.75]$, and $z_4 \in [3.28, 4.56]$

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

$$f(x) = 5x^4 + 2x^3 + 7x^2 + 7x + 2$$

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

B. $\pm 1, \pm 5$

C. $\pm 1, \pm 2$

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

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