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

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

A. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 2, \pm 4}$

B. $\pm 1, \pm 5$

C. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 5}$

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

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

$$f(x) = 15x^3 - 41x^2 - 70x - 24$$

A. $z_1 \in [-1.6, -0.3]$, $z_2 \in [-1.13, -0.54]$, and $z_3 \in [3.6, 5.1]$

B. $z_1 \in [-4.8, -3.7]$, $z_2 \in [1.46, 1.55]$, and $z_3 \in [1.4, 2.7]$

C. $z_1 \in [-4.8, -3.7]$, $z_2 \in [-0.16, 0.36]$, and $z_3 \in [2.9, 3.1]$

D. $z_1 \in [-2.4, -1.6]$, $z_2 \in [-1.57, -1.04]$, and $z_3 \in [3.6, 5.1]$

E. $z_1 \in [-4.8, -3.7]$, $z_2 \in [0.52, 1.2]$, and $z_3 \in [0.4, 1.3]$

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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.

$$\frac{15x^3 - 35x^2 + 22}{x - 2}$$

A. $a \in [25, 31], b \in [22, 26], c \in [49, 57]$, and $r \in [120, 130]$.

B. $a \in [15, 20], b \in [-20, -17], c \in [-20, -14]$, and $r \in [-2, 3]$.

C. $a \in [15, 20], b \in [-10, -4], c \in [-15, -3]$, and $r \in [-2, 3]$.

D. $a \in [25, 31], b \in [-96, -89], c \in [188, 191]$, and $r \in [-358, -354]$.

E. $a \in [15, 20], b \in [-71, -60], c \in [129, 132]$, and $r \in [-242, -232]$.

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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.*

$$f(x) = 9x^3 - 45x^2 - 16x + 80$$

A. $z_1 \in [-1.51, -1.32]$, $z_2 \in [1.27, 1.74]$, and $z_3 \in [4.92, 5.01]$

B. $z_1 \in [-5.05, -4.53]$, $z_2 \in [-1.86, -1.08]$, and $z_3 \in [1.31, 1.51]$

C. $z_1 \in [-5.05, -4.53]$, $z_2 \in [-4.03, -3.89]$, and $z_3 \in [0.28, 0.52]$

D. $z_1 \in [-1.02, -0.49]$, $z_2 \in [0.69, 1.02]$, and $z_3 \in [4.92, 5.01]$

E. $z_1 \in [-5.05, -4.53]$, $z_2 \in [-1.22, -0.61]$, and $z_3 \in [0.48, 0.81]$

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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.

$$\frac{10x^3 - 30x + 16}{x + 2}$$

A. $a \in [-24, -19], b \in [38, 41], c \in [-116, -104]$, and $r \in [235, 238]$.

B. $a \in [-24, -19], b \in [-43, -34], c \in [-116, -104]$, and $r \in [-204, -203]$.

C. $a \in [10, 12], b \in [-33, -29], c \in [57, 63]$, and $r \in [-173, -160]$.

D. $a \in [10, 12], b \in [-20, -18], c \in [7, 15]$, and $r \in [-6, 2]$.

E. $a \in [10, 12], b \in [15, 24], c \in [7, 15]$, and $r \in [34, 39]$.

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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.

$$\frac{10x^3 - 34x^2 + 6x + 23}{x - 3}$$

A. $a \in [8, 18], \; b \in [-7, -1], \; c \in [-8, 0], \text{ and } r \in [5, 8].$

B. $a \in [8, 18], \; b \in [-17, -9], \; c \in [-24, -20], \text{ and } r \in [-21, -19].$

C. $a \in [25, 32], \; b \in [-127, -121], \; c \in [374, 379], \text{ and } r \in [-1113, -1110].$

D. $a \in [8, 18], \; b \in [-64, -62], \; c \in [196, 199], \text{ and } r \in [-575, -565].$

E. $a \in [25, 32], \; b \in [56, 57], \; c \in [173, 182], \text{ and } r \in [540, 549].$

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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.

$$\frac{6x^3 + 23x^2 - 10x - 80}{x + 3}$$

A. $a \in [2, 10], \; b \in [3, 12], \; c \in [-25, -22], \text{ and } r \in [-8, -4].$

B. $a \in [-18, -10], \; b \in [75, 78], \; c \in [-245, -237], \text{ and } r \in [638, 646].$

C. $a \in [-18, -10], \; b \in [-31, -28], \; c \in [-104, -102], \text{ and } r \in [-396, -386].$

D. $a \in [2, 10], \; b \in [-4, 0], \; c \in [-7, -4], \text{ and } r \in [-60, -51].$

E. $a \in [2, 10], \; b \in [35, 42], \; c \in [113, 116], \text{ and } r \in [254, 262].$

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8. 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.*

$$f(x) = 10x^4 + 43x^3 - 67x^2 - 376x - 240$$

A. $z_1 \in [-3.8, -2.2], \; z_2 \in [-0.05, 0.7], z_3 \in [1.02, 1.73], \text{ and } z_4 \in [3.97, 4.18]$

B. $z_1 \in [-3.8, -2.2], \; z_2 \in [0.6, 1.1], z_3 \in [2.11, 2.94], \text{ and } z_4 \in [3.97, 4.18]$

C. $z_1 \in [-5.5, -3.5], \; z_2 \in [-1.3, -0.99], z_3 \in [-0.61, -0.35], \text{ and } z_4 \in [2.93, 3.31]$

D. $z_1 \in [-3.8, -2.2], \; z_2 \in [-0.05, 0.7], z_3 \in [3.99, 4.29], \text{ and } z_4 \in [4.71, 5.27]$

E. $z_1 \in [-5.5, -3.5]$, $z_2 \in [-2.64, -2.14]$, $z_3 \in [-0.89, -0.53]$, and $z_4 \in [2.93, 3.31]$

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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.*

$$f(x) = 20x^4 + 201x^3 + 648x^2 + 775x + 300$$

A. $z_1 \in [-6.28, -4.33]$, $z_2 \in [-3.6, -2]$, $z_3 \in [-1.8, -0.5]$, and $z_4 \in [-1.8, 0.2]$

B. $z_1 \in [-0.48, 0.33]$, $z_2 \in [1.5, 4.8]$, $z_3 \in [3.5, 5.1]$, and $z_4 \in [5, 6]$

C. $z_1 \in [0.29, 1.75]$, $z_2 \in [-0.4, 2.2]$, $z_3 \in [2.1, 3.3]$, and $z_4 \in [5, 6]$

D. $z_1 \in [-6.28, -4.33]$, $z_2 \in [-3.6, -2]$, $z_3 \in [-1.8, -0.5]$, and $z_4 \in [-1.8, 0.2]$

E. $z_1 \in [0.29, 1.75]$, $z_2 \in [-0.4, 2.2]$, $z_3 \in [2.1, 3.3]$, and $z_4 \in [5, 6]$

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

$$f(x) = 6x^2 + 5x + 7$$

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

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

C. $\pm 1, \pm 7$

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

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