Question #1 (No Calc)

Graph the following polynomial.

$$f(x) = -x^2(x+1)^3(3x-2)^2(-x-5)$$

State the:
- Leading term
- Zeros (with multiplicity)
- y-intercept
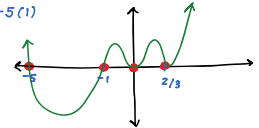- End behavior (in the correct notation)

Question #1 (No Calc)

Graph the following polynomial.

$$f(x) = -x^2(x+1)^3(3x-2)^2(-x-5)$$

State the:
- Leading term $-x^2 \cdot x^3 \cdot (3x)^2 \cdot (-x) = 9x^8$
- Zeros (with multiplicity) $0(2) \ -1(3) \ \frac{2}{3}(2) \ -5(1)$
- y-intercept $-0^2(1)^3(-2)^2(-5) = 0$
- End behavior (in the correct notation)
  $\lim_{x \to \infty} f(x) = \infty \quad \lim_{x \to -\infty} f(x) = \infty$

Question #2 (No Calc)

Find the vertex of the following quadratic.

$$y = 3x^2 - 12x + 5$$

Question #2 (No Calc)

Find the vertex of the following quadratic.

$$y = 3x^2 - 12x + 5$$

$h = \frac{-b}{2a} = \frac{12}{2(3)} = 2$

$k = c - ah^2 = 5 - (3)(2)^2 = -7$

or $k = 3(2)^2 - 12(2) + 5 = -7$ $\boxed{\text{Vertex } (2, -7)}$

Question #3 (Calc OK)

Find the linear factorization of the following polynomial (factor completely).

$$f(x) = x^4 + x^3 + 5x^2 - x - 6$$

Question #3 (Calc OK)

Find the linear factorization of the following polynomial (factor completely).

$$f(x) = x^4 + x^3 + 5x^2 - x - 6$$

$x = -1, 1$

$\boxed{f(x) = (x+1)(x-1)(x - (\frac{-1+i\sqrt{23}}{2}))(x - (\frac{-1-i\sqrt{23}}{2}))}$

$-1 | \ 1 \ \ 1 \ \ 5 \ -1 | -6$
$ \ \downarrow -1 \ \ 0 \ -5 \ \ | \ 6$
$ \ \ 1 \ \ 0 \ \ 5 \ -6 \ | \ 0$

$1 | \ 1 \ \ 0 \ \ 5 \ | -6$
$ \ \downarrow \ 1 \ \ 1 \ \ | \ 6$
$ \ \ 1 \ \ 1 \ \ 6 \ \ | \ 0$

$x = \frac{-1 \pm \sqrt{(1)^2 - 4(1)(6)}}{2(1)}$

$x = \frac{-1 \pm \sqrt{-23}}{2} = \frac{-1 \pm i\sqrt{23}}{2}$

$(x+1)(x^3 + 5x - 6)$

$(x+1)(x-1)(x^2 + x + 6)$

Question #4 (No Calc)

Write the equation of a quadratic that has a vertex of (2, -4) and goes through the point (-3, -24).

Question #4 (No Calc)

Write the equation of a quadratic that has a vertex of (2, -4) and goes through the point (-3, -24).

$$y = a(x-h)^2 + k$$
$$-24 = a(-3-2)^2 - 4$$
$$-20 = a(-5)^2$$
$$\frac{-20}{25} = \frac{25a}{25}$$
$$-\frac{4}{5} = a$$

$$y = -\frac{4}{5}(x-2)^2 - 4$$

Question #5 (No Calc)

Write the function with real coefficients whose zeros include 2 (multiplicity 2) and 3 + i (multiplicity 1).

Question #5 (No Calc)

Write the function with real coefficients whose zeros include 2 (multiplicity 2) and 3 + i (multiplicity 1).

$$y = (x-2)^2(x-(3+i))(x-(3-i))$$

Question #6 (No Calc)

Convert the following quadratic to vertex form:

$$y = -2x^2 + 12x - 7$$

Question #6 (No Calc)

Convert the following quadratic to vertex form:

$$y = -2x^2 + 12x - 7$$

$$h = \frac{-12}{2(-2)} = 3$$
$$k = -7 - (-2)(3)^2 = 11$$
$$\text{vertex } (3, 11)$$
$$a = -2$$

$$y = -2(x-3)^2 + 11$$

Question #7 (No Calc)

Find the remainder of the following polynomial.

$$(4x^4 - 3x^3 + 2x^2 - x + 1) \div (x - 1)$$

{Challenge} Can you find the remainder using another method?

Question #7 (No Calc)

Find the remainder of the following polynomial.

$$(4x^4 - 3x^3 + 2x^2 - x + 1) \div (x - 1)$$

{Challenge} Can you find the remainder using another method?

$$\begin{array}{r|rrrr|r} 1 & 4 & -3 & 2 & -1 & 1 \\ & \downarrow & 4 & 1 & 3 & 2 \\ \hline & 4 & 1 & 3 & 2 & ③ \end{array}$$

OR

$$4(1)^4 - 3(1)^3 + 2(1)^2 - (1) + ($$
$$4 - 3 + 2 - 1 + 1$$
$$③$$

Question #8 (No Calc)

Write the equation of a line in point-slope form if f(-2)=3 and f(1)=6.

{Challenge}: Can you write another equation of the same line in point-slope form?

Question #8 (No Calc)

Write the equation of a line in point-slope form if f(-2)=3 and f(1)=6.

$(-2,3)$ $(1,6)$

{Challenge}: Can you write another equation of the same line in point-slope form?

$$m = \frac{6-3}{1+2} = \frac{3}{3} = 1$$

$$y - 3 = 1(x+2)$$
$$y - 6 = 1(x-1)$$
OR
in slope-int: $y = x + 5$

Question #9 (No Calc)

Find the end behavior of the following polynomial. Be sure to write it in proper limit notation.

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

Question #9 (No Calc)

Find the end behavior of the following polynomial. Be sure to write it in proper limit notation.

$$f(x) = 3x^③ - 4x^2 + 2x + 5$$

right ↑, Left ↓

$$\lim_{x \to \infty} f(x) = \infty \qquad \lim_{x \to -\infty} f(x) = -\infty$$

Question #10 (No Calc)

What is the leading term, leading coefficient and degree of the following polynomial?

$$f(x) = 3(5-x)(x-4)^2(x-2)^3$$

Question #10 (No Calc)

What is the leading term, leading coefficient and degree of the following polynomial?

$$f(x) = \underline{3}(5-\underline{x})(\underline{x}-4)^{\textcircled{2}}(\underline{x}-2)^{\textcircled{3}}$$

L.T. : $3 \cdot (-x) \cdot x^2 \cdot x^3 = -3x^6$

L.C. : -3

Degree : 6

Question #11 (Calc OK)

Graph the following polynomial.

$$f(x) = 3(5-x)(x-4)^2(x-2)^3$$

State the:
- Leading term
- Zeros (with multiplicity)
- y-intercept
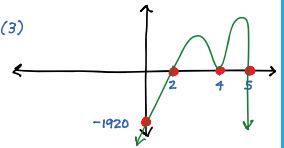- End behavior (in the correct notation)

Question #11 (Calc OK)

Graph the following polynomial.

$$f(x) = 3(5-x)(x-4)^2(x-2)^3$$

State the:
- Leading term : $3(-x)(x)^2(x)^3 = -3x^6$
- Zeros (with multiplicity) $5\,(1)\ \ 4\,(2)\ \ 2\,(3)$
- y-intercept $3(5)(-4)^2(-2)^3 = -1920$
- End behavior (in the correct notation)
  $\lim\limits_{x \to \infty} f(x) = -\infty$ $\quad \lim\limits_{x \to -\infty} f(x) = -\infty$

Question #12 (Calc OK)

Find the linear factorization of the following polynomial (factor completely).

$$f(x) = 3x^3 - x^2 - 13x - 5$$

Question #12 (Calc OK)

Find the linear factorization of the following polynomial (factor completely).

$$f(x) = 3x^3 - x^2 - 13x - 5$$

$x = -1\frac{2}{3}\ \left(-\frac{5}{3}\right)$

$f(x) = (3x+5)(x-(1+\sqrt{2}\,))(x-(1-\sqrt{2}\,))$

$$\begin{array}{c|cccc} -\frac{5}{\textcircled{3}} & 3 & -1 & -13 & -5 \\ & \downarrow & -5 & 10 & 5 \\ \hline & \frac{3}{3} & \frac{-6}{3} & \frac{-3}{3} & 0 \end{array}$$

$(3x+5)(x^2 - 2x - 1)$

$x = \dfrac{2 \pm \sqrt{(-2)^2 - 4(1)(-1)}}{2(1)}$

$x = \dfrac{2 \pm \sqrt{8}}{2}$

$x = \dfrac{2 \pm 2\sqrt{2}}{2} = 1 \pm \sqrt{2}$

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Question #13 (Calc OK)

The Hinsdale Little League uses a baseball throwing machine to help train 10-year-old players to catch high pop-ups. If the machine throws the baseball straight up with an initial velocity of 48 ft/sec from a height of 3.5 ft ...

a. Find an equation that models the height, h(t), of the ball t seconds after it is thrown.

b. What is the maximum height the baseball with reach? How many seconds will it take to reach that height?