JEOPARDY

100 POINTS:

$2(3)^5 - 3(3)^2 - 17(3) + 1$

Given: $f(x) = 2x^5 - 3x^2 - 17x + 1$

(a) Is $x - 3$ a factor?   NO, when you plug $x = 3$ in you get 409.

(b) Why or why not?   remainder not 0

200 POINTS:

$(-5)^4 + 9(-5)^3 + 23(-5)^2 + 21(-5) + 30$

Given: $f(x) = x^4 + 9x^3 + 23x^2 + 21x + 30$?

(a) Is -5 a solution?   yes, because remainder 0.

(b) If yes, what is the factor? $(x + 5)$

300 POINTS: Factor: $18y^4 - 15y^3 + 3y^2$

$3y^2(6y^2 - 5y + 1)$

$\boxed{3y^2(3y - 1)(2y - 1)}$ Answer

400 POINTS: Use the Rational Root Theorem to find all roots.

$$f(x) = x^4 + x^3 + 7x^2 + 9x - 18$$
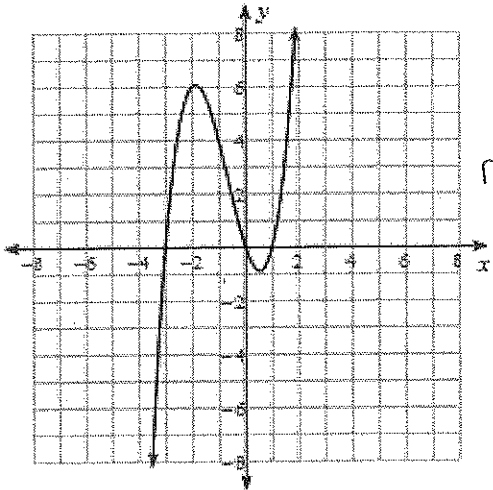
(You can use back of this paper for work!)

Possible Roots: ± 1 ± 2 ± 3 ± 6 ± 9 ± 18

Actual Roots: $3i, -3i, -2, 1$

Factored Form: $(x^2 + 9)(x + 2)(x - 1)$
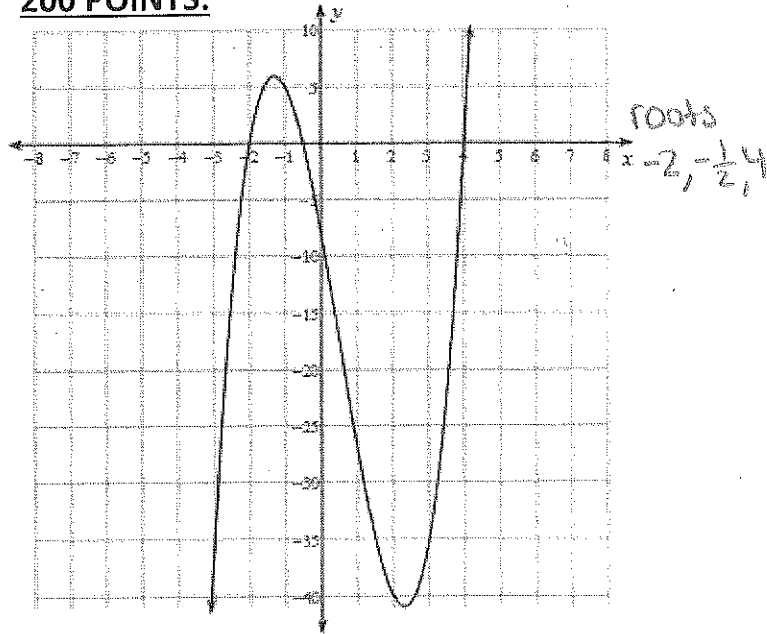
100 POINTS:

roots:
-3, 0, 1

$$x(x-1)(x+3)$$

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

$$x^3+3x^2-x^2-3x$$

$$\boxed{x^3+2x^2-3x}$$

Answer

200 POINTS:

roots
$-2, -\frac{1}{2}, 4$

$$(x+2)(2x+1)(x-4)$$

$$(2x^2+5x+2)(x-4)$$

$$2x^3-8x^2+5x^2-20x+2x-8$$

$$\boxed{2x^3-3x^2-18x-8}$$

300 POINTS:

Write the equation of the polynomial with roots:
-1 *multiplicity* 2 *and* $3i$

$$(x+1)(x+1)(x^2+9)$$

$$(x^2+2x+1)(x^2+9)$$

$$x^4+9x^2+2x^3+18x+x^2+9$$

$$\boxed{x^4+2x^3+10x^2+18x+9}$$

400 POINTS:

Write the equation of the polynomial with roots:
$\frac{-5}{2}$ *and* $\sqrt{6}$

$$(2x+5)(x^2-6)$$

$$2x^3-12x+5x^2-30$$

$$\boxed{2x^3+5x^2-12x-30}$$

100 POINTS: **What is the difference between synthetic division and long division?**

You can only use synthetic division when you have a leading coefficient of 1 and degree 1 for the divisor.

200 POINTS: **Multiply.** $(3x - 2)(x^3 - 6x + 1)$

$$3x^4 - 18x^2 + 3x - 2x^3 + 12x - 2$$

$$\boxed{3x^4 - 2x^3 - 18x^2 + 15x - 2} \quad \text{Answer}$$

300 POINTS: **Multiply.** $(3x^2y^5 - 11x)(-4x^3 - 3y^2 + 7)$

$$-12x^5y^5 - 9x^2y^7 + 21x^2y^5 + 44x^4 + 33xy^2 - 77x$$

$$\boxed{-12x^5y^5 + 44x^4 - 9x^2y^7 + 21x^2y^5 + 33xy^2 - 77x}$$

400 POINTS: **Use Synthetic Division.** $(x^3 - 28x - 48) \div (x + 4)$

$$
\begin{array}{r|rrrr}
-4 & 1 & 0 & -28 & -48 \\
   &   & -4 & 16 & 48 \\
\hline
   & 1 & -4 & -12 & 0
\end{array}
$$

$$\boxed{x^2 - 4x - 12}$$

500 POINTS: **Use long division.** $(-70v - 38v^3 + 57 + 28v^4 - 56v^2 + 16v^5) \div (10 + 4v)$

$$\boxed{4v^4 - 3v^3 - 2v^2 - 9v + 5 \quad R\,7} \leftarrow \text{Answer}$$

$$
\begin{array}{r}
4v + 10 \enclose{longdiv}{16v^5 + 28v^4 - 38v^3 - 56v^2 - 70v + 57}
\end{array}
$$

$$-16v^5 + 40v^4$$

$$-12v^4 - 38v^3 - 56v^2 - 70v + 57$$
$$+12v^4 + 30v^3$$

$$-8v^3 - 56v^2 - 70v + 57$$
$$+8v^3 + 20v^2$$

$$-36v^2 - 70v + 57$$
$$+36v^2 + 90v$$

$$20v + 57$$
$$-20v + 50 \qquad 7$$

100 POINTS: Solve. $(3x^3 - 2x^2) - 9x + 6 = 0$

$$x^2(3x-2) - 3(3x-2) = 0$$
$$(x^2-3)(3x-2) = 0$$

$x^2 - 3 = 0$ $3x - 2 = 0$
$x^2 = 3$ $x = 2/3$
$x = \pm\sqrt{3}$

roots: $\sqrt{3}, -\sqrt{3}, \frac{2}{3}$

200 POINTS: Solve. $x^4 - 13x^2 + 36 = 0$

$$(x^2-9)(x^2-4) = 0$$

$x^2 - 9 = 0$ $x^2 - 4 = 0$
$x^2 = 9$ $x^2 = 4$
$x = \pm 3$ $x = \pm 2$

Roots: $3, -3, 2, -2$

300 POINTS: Solve. $81x^4 - 1 = 0$

$$(9x^2-1)(9x^2+1)$$
$$(3x-1)(3x+1)(9x^2+1)$$

$3x-1=0$ $3x+1=0$ $9x^2+1=0$
$x = 1/3$ $x = -1/3$ $\frac{9x^2}{9} = \frac{-1}{9}$
                             $x^2 = \frac{-1}{9} = \frac{\sqrt{-1}}{\sqrt{9}} = \frac{\pm i}{3}$

Roots: $\frac{1}{3}, -\frac{1}{3}, \frac{i}{3}, -\frac{i}{3}$

400 POINTS: Just Factor! $8x^6 - 27y^3$ $a =$ $b =$

General form: $(a - b)(a^2 + ab + b^2)$ $2x^2$ $3y$

$$(2x^2-3y)(4x^4+6x^2y+9y^2)$$

500 POINTS: Just Factor! $2x^4 + 16x$ $a = x$ $b = 2$

General form: $(a + b)(a^2 - ab + b^2)$ $2x(x^3+8)$

$$2x(x+2)(x^2-2x+4)$$

100 POINTS: Write in the following in standard form: $6xy^2 - 8x^3 + 16y^3 - 4x^2y$

$$-8x^3 - 4x^2y + 6xy^2 + 16y^3$$

200 POINTS: Add. $(7r + 2r^4 + 1) + (6r + 3r^4 - 8)$

$$5r^4 + 13r - 7$$

300 POINTS: Subtract. $(6 + 3r + r^2 - 3r^4) - (4 - 2r - 6r^4)$

$$6 + 3r + r^2 - 3r^4 - 4 + 2r + 6r^4$$

$$3r^4 + r^2 + 5r + 2$$

400 POINTS: Simplify. $(8r - 4r^2 + 6r^4) + (2r^3 - r^2 - 7r^4) - (7r^3 - r^4 - 6r^2)$

$$8r - 4r^2 + 6r^4 + 2r^3 - r^2 - 7r^4 - 7r^3 + r^4 + 6r^2$$

$$-5r^3 + r^2 + 8r$$

500 POINTS: Complete the following table.

Problem	Classify by degree	Classify by term
-10	Constant	monomial
$5x^2 - 18$	Quadratic	binomial
$7x - 8x^3 + 19 - 12x^2$	cubic	polynomial
$x^4 - 13 + 19x$	Quartic	trinomial
$5x - 1$	linear	binomial
$x^4 - 9x^2 - 2x^5$	quintic	trinomial
$x^8 - 10x^2 + 19x - 8x^3 - 5x^9 - x^6$	degree of 9	polynomial

100 POINTS: Write in the following in standard form: $6xy^2 - 8x^3 + 16y^3 - 4x^2y$

200 POINTS: Add. $(7r + 2r^4 + 1) + (6r + 3r^4 - 8)$

300 POINTS: Subtract. $(6 + 3r + r^2 - 3r^4) - (4 - 2r - 6r^4)$

400 POINTS: Simplify. $(8r - 4r^2 + 6r^4) + (2r^3 - r^2 - 7r^4) - (7r^3 - r^4 - 6r^2)$

500 POINTS: Complete the following table.

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$5x^2 - 18$		
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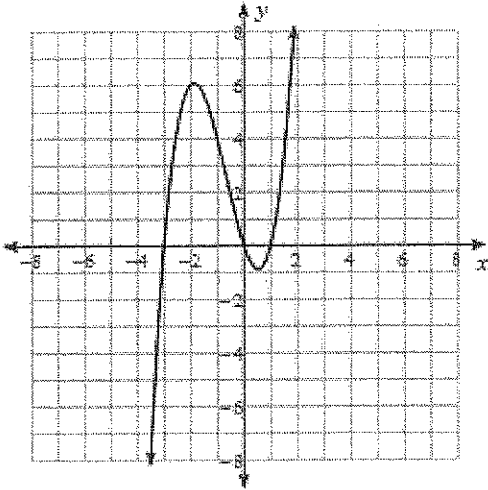**500 POINTS:**   **Just Factor!** $2x^4 + 16x$ a =   b =
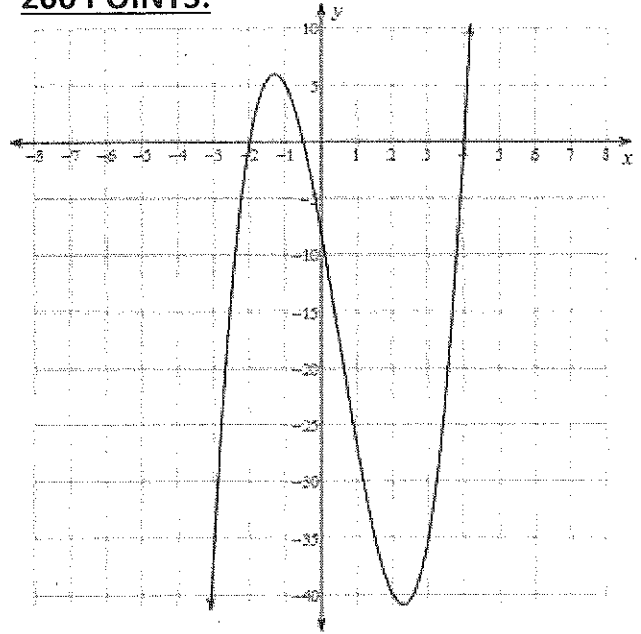
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Actual Roots:

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