

Name: KEY

Score: _____ / 100

Student ID: _____

DO NOT OPEN THE EXAM UNTIL YOU ARE TOLD TO DO SO

	1	2	3	4	5	6	7	8	9	10	11	12	Total
✓													
Score													

INSTRUCTIONS FOR STUDENTS

- Questions are on both sides of the paper. This is an 11 question exam (One extra credit problem can be attempted for a total of 12 questions).
- Students have 2 hours and 15 minutes to complete the exam.
- **PLEASE SHOW ALL WORK.** Any unjustified claims will receive no credit. Clearly box your final answer.
- You **MUST** complete 11 problems for credit. In the above table in the row with the ✓, please mark with a ✓ which problems you want to be graded. If you wish to do a 12th problem for extra credit, please write *EC* in the ✓ row for the problem you wish to be counted for extra credit.
- No notes, textbooks, phones, calculators, etc. are allowed for the exam.
- Each of the 11 questions you choose to do will be graded out of 3 points. The score will then be totaled and multiplied by 3 to get a raw score out of 99 points. One point will be given for clearly writing your name on the exam sheet. This will get you to 100 points. If you choose to do a 12th problem for extra credit, the most that will be awarded for that question will be 3 points. So, the highest possible score on this examination is 103 points out of 100.
- The back of the test can be used for scratch work.

GOOD LUCK!

1) Use the rules of exponents to simplify the expression, do not use negative exponents:

$$\frac{(5x^4y^3)^2}{3^{-1}x^{-8}y^6}$$

$$\frac{(5x^4y^3)^2}{3^{-1}x^{-8}y^6} = \frac{25x^8y^6}{3^{-1}x^{-8}y^6} = 3 \cdot 25x^{8-(-8)}y^{6-6}$$

$$= \boxed{75x^{16}}$$

2) Use the rules of exponents to simplify the expression, do not use negative exponents:

$$\left(\frac{4^{-2}a^{-3}b}{2^{-2}a^3b^2}\right)^{-1}$$

$$\left(\frac{4^{-2}a^{-3}b}{2^{-2}a^3b^2}\right)^{-1} = \frac{4^2a^3b^{-1}}{2^2a^{-3}b^{-2}} = \frac{16a^3b^{-1}}{4a^{-3}b^{-2}}$$

$$\Rightarrow = 4a^{3-(-3)}b^{-1-(-2)}$$

$$\Rightarrow = \boxed{4a^6b}$$

3) Write each of the following in scientific notation:

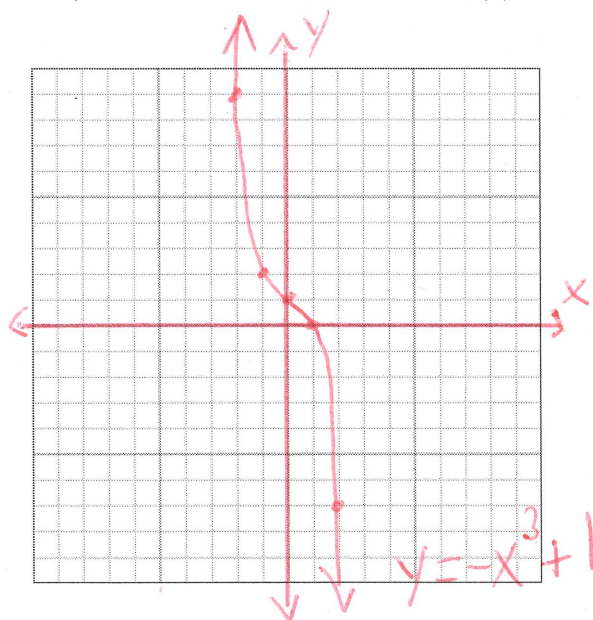
- a) 0.000004254
 b) 232,300,000
 c) 456



a) 0.000004254 6 right
 $= \boxed{4.254 \times 10^{-6}}$

b) 232,300,000 8 left
 $= \boxed{2.323 \times 10^8}$

c) 456 2 left
 $\boxed{4.56 \times 10^2}$

4) Graph the following polynomial: $f(x) = -x^3 + 1$



$x^3 \Rightarrow$  $-x^3 \Rightarrow$ 

x	y = -x ³ + 1
-2	9
-1	2
0	1
1	0
2	-7

5) Expand the following binomial $(7x^2 + y)^2$

$$A = 7x^2 \quad B = y \quad \text{Apply Eqn 1}$$

$$(7x^2 + y)^2 = (7x^2)^2 + 2(7x^2)(y) + (y)^2$$

$$= \boxed{49x^4 + 14x^2y + y^2}$$

6) Perform the following division using either polynomial division or synthetic division:

$$\begin{array}{r} x^3 - x^2 + x - 1 \\ x-2 \overline{) x^4 - 3x^3 + 3x^2 - 3x + 2} \\ \underline{-(x^4 - 2x^3)} \\ -x^3 + 3x^2 - 3x + 2 \\ \underline{-(-x^3 + 2x^2)} \\ x^2 - 3x + 2 \\ \underline{-(x^2 - 2x)} \\ -x + 2 \\ \underline{-(-x + 2)} \\ 0 \end{array}$$

$$\boxed{x^3 - x^2 + x - 1}$$

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

Synthetic Division

$$x - 2 = 0 \Rightarrow x = 2$$

	x^4	x^3	x^2	x	const
2	1	-3	3	-3	2
	↓	2	-2	2	-2
	1	-1	1	-1	0
	x^3	x^2	x	const	

$$\boxed{x^3 - x^2 + x - 1}$$

7) Factor the equation completely: $x^2 - ax - x + a$

$$\begin{aligned} & \boxed{x^2 - ax} - x + a \\ &= x(x-a) - (x-a) \\ &= \boxed{(x-a)(x-1)} \end{aligned}$$

8) Factor the equation completely: $3a^2 - 3a - 36$
(Do not use quadratic formula)

$$\begin{aligned} & 3a^2 - 3a - 36 \\ &= 3(a^2 - a - 12) \\ &= \boxed{3(a-4)(a+3)} \end{aligned}$$

inside

Factors -12	Sum
1, -12	-11
-1, 12	11
2, -6	-4
-2, 6	4
-3, 4	1
3, -4	-1

Directly

Factors -36	$3a^2$
1, -36	$3a, a$
-1, 36	
2, -18	
-2, 18	
3, -12	
-3, 12	
4, -9	
-4, 9	
-6, 6	

9) Solve the following equation for x by factoring the left hand side: $5x^2 - 7x - 6 = 0$
(Do not use quadratic formula)

$$5x^2 - 7x - 6 = 0$$

$$5x^2 - 10x + 3x - 6 = 0$$

$$5x(x-2) + 3(x-2) = 0$$

$$(5x+3)(x-2) = 0$$

$$5x+3=0 \quad x-2=0$$

$$\boxed{x = -\frac{3}{5}} \quad \boxed{x = 2}$$

Add to -7
Mult to $5(-6) = -30$

Factors	Sum
1, -30	-29
-1, 30	29
2, -15	-13
-2, 15	13
3, -10	-7
-3, 10	7

10) Factor the equation completely: $128t^3s^6 - 432z^9$

$$128t^3s^6 - 432z^9$$

$$\Rightarrow 16(8t^3s^6 - 27z^9)$$

$$F^3 = 8t^3s^6 \Rightarrow F = 2ts^2$$

$$L^3 = 27z^9 \Rightarrow L = 3z^3$$

$$\Rightarrow \boxed{16(2ts^2 - 3z^3)(4t^2s^4 + 6ts^2z^3 + 9z^6)}$$

\Rightarrow Final answer \rightarrow

Factors (9)(4) = 36	Sum 6
1, 36	37
-1, -36	-37
2, 18	20
-2, -18	-20
3, 12	15
-3, -12	-15
4, 9	13
-4, -9	-13
None match	

- 11) Solve the following equation for x : $4x^2 + 1 = 16x + 1$
(Do not use quadratic formula)

$$\begin{aligned} 4x^2 + 1 &= 16x + 1 \\ \hline 4x^2 &= 16x \\ \Rightarrow 4x^2 - 16x &= 0 \\ 4x(x-4) &= 0 \\ \boxed{x=0 \quad x=4} \end{aligned}$$

- 12) The area of a rectangular field is 24 mi^2 . The length is 10 less than four times the width. Find the dimensions of the field (the length and width). Label the units for the length and width. You must show work by defining functions for area, length and/or width in order to receive full credit.

$$\begin{aligned} w \quad \boxed{A=24} \\ l = 4w - 10 \end{aligned}$$

$$\begin{aligned} A &= lw \\ A &= (4w - 10)w \\ A &= 4w^2 - 10w \\ 24 &= 4w^2 - 10w \\ 0 &= 4w^2 - 10w - 24 \\ 0 &= 2(2w^2 - 5w - 12) \\ 0 &= 2(2w + 3)(w - 4) \end{aligned}$$

$$\begin{array}{r} 2w + 3 \\ w \quad \boxed{\begin{array}{|c|c|} \hline 2w^2 & 3w \\ \hline -4 & -8w - 12 \\ \hline \end{array}} \end{array}$$

$$\begin{aligned} \Rightarrow w &= \frac{-3}{2} \quad w = 4 \\ l &= 4w - 10 \\ &= 4(4) - 10 \\ &= 6 \end{aligned}$$

$$\boxed{\begin{aligned} l &= 6 \text{ mi} \\ w &= 4 \text{ mi} \end{aligned}}$$