1) Evaluate the expression below for $x = -3$ and $y = 4$.

$$x^2 - 2(y - x) - 5$$

A -16
B -28
C 2
D 0
E -10

$= (-3)^2 - 2(4 - (-3)) - 5$ Substitute numbers
$= (-3)^2 - 2(4 + 3) - 5$ Get ride of 'double negative'
$= (-3)^2 - 2(7) - 5$ Evaluate inside parentheses
$= 9 - 2(7) - 5$ Evaluate the exponent (power)
$= 9 - 14 - 5$ Do multiplication
$= -10$ Do subtraction left to right

2) Which statement(s) below is(are) **true**?

I The number $-\sqrt{5}$ is a rational number.
II $\frac{\pi}{3} \le \frac{\pi}{3}$
III $|-12 + 5| = 7$

A II only
B II and III only
C I and III only
D III only
E I and II only

I is false. $-\sqrt{5}$ is **an irrational** number.

II is true. $\frac{\pi}{3} = \frac{\pi}{3}$ The first must either be less than the second or equal to the second.

III is true $|-12 + 5| = |-7| = 7$

Answer is II and III only.

3) Simplify. $4(x - 2y) + 2[3 - (3x + 2y)]$

A $-2x - 12y + 6$
B $x + 6$
C $2x - 10y + 6$
D $-2x - 4y + 6$
E $x - 10y + 6$

$4(x - 2y) + 2[3 - (3x + 2y)]$
$= 4(x - 2y) + 2[3 - 3x - 2y]$ Clear parentheses inside brackets
$= 4x - 8y + 6 - 6x - 4y$ Distribute through parentheses and brackets
$= -2x - 12y + 6$ Combine 'like' terms

4) Simplify. $\left(-5x^2y^3\right)\left(-2x^2y^{-5}\right)^2$

A $\dfrac{100x^{12}}{y^4}$

B $\dfrac{-20x^6}{y^7}$

C $\dfrac{-20x^8}{y^{30}}$

D $-20x^6$

E $\dfrac{10x^6}{y^7}$

$\left(-5x^2y^3\right)\left(-2x^2y^{-5}\right)^2$

$=(-5x^2y^3)((-2)^2x^4y^{-10})$ Raise every factor of 2nd parenthese to 2nd power

$=(-5x^2y^3)(4x^4y^{-10})$

$=-20x^6y^{-7}$ Use product rule; add exponents

$=\dfrac{-20x^6}{y^7}$ Use negative exponent rule

5) Use scientific notation to evaluate. Write the answer in scientific notation.

$$\frac{0.0072\times30000}{0.00027}$$

A 8×10^{-3}

B 8×10^{4}

C 8×10^{5}

D 8×10^{-8}

E None of the above.

$$\frac{0.0072\times30000}{0.00027}=\frac{7.2\times10^{-3}\bullet3\times10^{4}}{2.7\times10^{-4}}=\frac{(7.2\bullet3)(10^{-3}\times10^{4})}{2.7\times10^{-4}}$$

$$=\frac{21.6\times10^{1}}{2.7\times10^{-4}}=\frac{21.6}{2.7}\times\frac{10}{10^{-4}}=8\times10^{5}$$

6) Simplify. $\sqrt{75a^9b^4c}$

A $5a^3b^2\sqrt{3c}$

B $5a^3b^2c\sqrt{3}$

C $5a^4b^2\sqrt{3ac}$

D $5ab\sqrt{3ac}$

E $5a^4b^2\sqrt{3c}$

$\sqrt{75a^9b^4c}$

$=\sqrt{25\bullet3a^8ab^4c}$ Factor so that there are perfect squares and 'leftovers'

$=5a^4b^2\sqrt{3ac}$ Take the square roots of 25, a^8, and b^4 out of sign

7) Which statement is **false**?

A $25^{\frac{3}{2}} = 125$

B $(-8)^{\frac{5}{3}} = -32$

C $16^{\frac{1}{4}} = 4$

D $64^{-\frac{1}{3}} = \frac{1}{4}$

E $5^{-1} = \frac{1}{5}$

A $25^{\frac{3}{2}} = \left(\sqrt{25}\right)^3 = 5^3 = 125$ *A* is true

B $(-8)^{\frac{5}{3}} = \left(\sqrt[3]{-8}\right)^5 = (-2)^5 = -32$ *B* is true

C $16^{\frac{1}{4}} = \sqrt[4]{16} = 2$ *C* is false

D $64^{-\frac{1}{3}} = \frac{1}{64^{1/3}} = \frac{1}{\sqrt[3]{64}} = \frac{1}{4}$ *D* is true

E $5^{-1} = \frac{1}{5}$ *E* is true

8) Subtract: $(4x^3 - 2x^2 + 9) - (3x^2 + 2x - 11 - x^3)$

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

B $2x^3 - 5x^2 + 2x - 2$

C $5x^3 - 5x^2 - 2x - 2$

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

E None of the above.

$= 4x^3 - 2x^2 + 9 - 3x^2 - 2x + 11 + x^3$ Distribute -1 through ()

$= 5x^3 - 5x^2 - 2x + 20$ Combine like terms

9) Which statement is **true**?

A $(y-11)^2 = y^2 - 22y + 121$

B $(6r^2 - 1)(6r^2 + 1) = 36r^2 - 1$

C $(2x + 5y)(3x - 12y) = 6x^2 + 9xy - 60y^2$

D $(9a + 2)^2 = 81a^2 + 18a + 4$

E $(7m + 9n)(7m - 9n) = 49m^2 + 81n^2$

$(y-11)(y-11) = y^2 - 11y - 11y + 121 = y^2 - 22y + 121$ true

$(6r^2 - 1)(6r^2 + 1) = 36r^4 - 1$ not $36r^2 - 1$ exponent wrong, false statement

$(2x + 5y)(3x - 12y) = 6x^2 - 24xy + 15xy - 60y^2$

$= 6x^2 - 9xy - 60y^2$ not $+9xy$ for middle term false

$(9a + 2)^2 = (9a + 2)(9a + 2) = 81a^2 + 18a + 18a + 4 = 81a^2 + 36a + 4$

not a middle term of only $18a$ false statement

$(7m + 9n)(7m - 9n) = 49m^2 - 81n^2$, sign is a $-$, not a $+$ false statement

10) What is one factor of $x^2+2xy-5x-10y$?

A $x-2y$
B $x+5$
C $x-y$
D $x-5$
E None of the above.

$x^2+2xy \quad -5x-10y$
$=x(x+2y)-5(x+2y)$
$=(x+2y)(x-5)$

Answer: $x-5$

11) Factor $16y^4-81$ **completely.**

A $(4y^2-9)^2$
B $(4y^2+1)(y+9)(y-9)$
C $(2y-3)^4$
D $(2y+3)^2(2y-3)^2$
E $(4y^2+9)(2y+3)(2y-3)$

$16y^4-81$ difference of squares
$=(4y^2+9)(4y^2-9)$ difference of squares again
$=(4y^2+9)(2y+3)(2y-3)$
(Remember, a sum of squares is prime.)

12) Divide and simplify. $\dfrac{a^2+6a+9}{a^2+5a+6}\div\dfrac{a^2+2a}{a^2-4}$

A $\dfrac{a-3}{a}$
B $\dfrac{3a(2a+3)}{-2(5a+6)}$
C $\dfrac{a(a+3)}{(a+2)(a-2)}$
D $\dfrac{(a+3)(a-2)}{a(a+2)}$
E None of the above.

$\dfrac{a^2+6a+9}{a^2+5a+6}\div\dfrac{a^2+2a}{a^2-4}$ factor each numerator and denominator

Convert to multiply by reciprocal of divisor

$=\dfrac{\cancel{(a+3)}(a+3)}{\cancel{(a+3)}\cancel{(a+2)}}\cdot\dfrac{\cancel{(a+2)}(a-2)}{a(a+2)}$

Cancel

$=\dfrac{(a+3)(a-2)}{a(a+2)}$

13) Add and simplify, if possible. $\frac{1}{x-1}+\frac{3}{x^2-1}+\frac{1}{x}$

A $\frac{2x^2+4x-1}{x(x+1)(x-1)}$

B $\frac{x^2+3x}{(x+1)(x-1)}$

C $\frac{5}{x(x+1)(x-1)}$

D $\frac{2x^2+2x-1}{x(x+1)(x-1)}$

E $\frac{5x}{(x+1)(x-1)}$

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

$=\frac{1}{x-1}+\frac{3}{(x+1)(x-1)}+\frac{1}{x}$

$LCD=x(x+1)(x-1)$

$=\frac{1}{x-1}\cdot\frac{x(x+1)}{x(x+1)}+\frac{3}{(x+1)(x-1)}\cdot\frac{x}{x}+\frac{1}{x}\cdot\frac{(x+1)(x-1)}{(x+1)(x-1)}$

$=\frac{x(x+1)+3x+(x+1)(x-1)}{x(x+1)(x-1)}$

$=\frac{x^2+x+3x+x^2-1}{x(x+1)(x-1)}$

$=\frac{2x^2+4x-1}{x(x+1)(x-1)}$

14) Solve this equation. Select which statement describes the solution.

$$\frac{5}{x-2}+\frac{2}{x}=\frac{2}{x-2}$$

A The solution is less than -2.

B The solution is at least -2, but less than -1.

C The solution is at least -1, but less than 0.

D The solution is at least 0, but less than 1.

E The solution is 1 or greater.

$\frac{5}{x-2}+\frac{2}{x}=\frac{2}{x-2}$ $\quad LCD=x(x-2)$

Multiply both sides by $x(x-2)$ and distribute.

$x(x-2)\left[\frac{5}{x-2}+\frac{2}{x}\right]=x(x-2)\left[\frac{2}{x-2}\right]$

$x(x-2)\left[\frac{5}{x-2}\right]+x(x-2)\left[\frac{2}{x}\right]=x(x-2)\left[\frac{2}{x-2}\right]$

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

$5x+2x-4=2x$

$7x-4=2x$

$5x=4$

$x=\frac{4}{5}$

$\frac{4}{5}$ is between 0 and 1

15) The length of a picture frame is 1 inch less than twice its width. If the picture frame has a perimeter of 58 inches, which equation could be used to find the width of the frame? **Let *w* represent the width**. Then, find the width of the frame.

A	$2w+2(2w-1)=58,$	$10\,in.$
B	$w+2w-1=58,$	$19\frac{1}{3}\,in.$
C	$2w+2(2w)-1=58,$	$10\,in.$
D	$4w-1=58,$	$14\frac{3}{4}\,in.$
E	$2w+2(w-1)=58,$	$15\,in.$

Let w = width
$2w$ -1 = length
2(width) + 2(length) = perimeter
$2w+2(2w-1)=58$
$2w+4w-2=58$
$6w-2=58$
$6w=60$
$w=10$ width: 10 *in.*