

KEY

1. [3-points] Let

$$A = \left\{ 1, \sqrt{18}, 51, -\frac{3\pi}{2}, 0.0131313\dots, \sqrt[3]{8}, 0.1010010001\dots \right\}.$$

(a) List all rational numbers in A.

$$1, 51, 0.0131313\dots, \sqrt[3]{8} = 2$$

1 point

See Example 1 (b) List all irrational numbers in A.

$$\sqrt{18}, -\frac{3\pi}{2}, 0.1010010001\dots$$

P. 4 and Problems 1-2

P. 15

1 point

(c) List all prime numbers in A.

$$\sqrt[3]{8} = 2$$

1 point

2. [3-points] Write the number

$$\frac{(21 \times 10^{-8})(160 \times 10^{-3})}{(4 \times 10^4)(700 \times 10^{-6})}$$

in scientific notation.

$$= \frac{21 \times 16 \times 10 \times 10^{-8} \times 10^{-3}}{4 \times 7 \times 100 \times 10^4 \times 10^{-6}}$$

1 point

$$= 12 \times 10^{1-8-3-2-4+6}$$

1 point

$$= 12 \times 10^{-10} = 1.2 \times 10^{-11}$$

1 point

See Example 3 P. 23

and Problems 23-48 P. 32

3. [4-points] If $-3 < x < -1$, then write the expression

$$|3 + x| + |2 + 2x| + ||-x||$$

See Problems 31-40
P. 16

without the absolute value symbols.

$$x > -3 \Rightarrow x + 3 > 0 \Rightarrow |x + 3| = x + 3 \quad \underline{1 \text{ Point}}$$

$$x < -1 \Rightarrow x + 1 < 0 \Rightarrow 2 + 2x < 0$$

$$\Rightarrow |2 + 2x| = -(2 + 2x)$$

1 point

$$||-x|| = |x| = -x \quad \underline{1 \text{ Point}}$$

$$\Rightarrow \text{The expression} = 3 + x - 2 - 2x - x = -2x + 1$$

1 point

4. [4-points] Simplify $\frac{(2x^{2/3}y^{1/2})(3x^{1/6}y^{1/3})}{x^{17/6}y^{-7/6}}$. [Write the answer with positive exponents]

$$= 6 x^{\frac{2}{3} + \frac{1}{6} - \frac{17}{6}} y^{\frac{1}{2} + \frac{1}{3} + \frac{7}{6}}$$

2 points

$$= 6 x^{-\frac{12}{6}} y^{\frac{12}{6}}$$

1 points

$$= \frac{6y^2}{x^2}$$

1 points

See example 2 P. 22
and Problems 59-70 P. 32

5. [4-points] Rationalize the denominator and write the result in simplest

form $\frac{3\sqrt{5} + 2\sqrt{10}}{3\sqrt{5} - 2\sqrt{10}}$

$$= \frac{(3\sqrt{5} + 2\sqrt{10})(3\sqrt{5} + 2\sqrt{10})}{(3\sqrt{5} - 2\sqrt{10})(3\sqrt{5} + 2\sqrt{10})}$$

1 point

$$= \frac{45 + 40 + 12\sqrt{50}}{45 - 40}$$

2 points

$$= \frac{85}{5} + \frac{60}{5}\sqrt{2} = 17 + 12\sqrt{2}$$

1 point

See example 9 P.31

and Problems 107-112 P.33

6. [5-points] Simplify
- $\frac{x}{(x-3)^2} + \frac{x^2+2x}{x+5} \div \frac{(x+2)(x-3)}{x+5}$

$$= \frac{x}{(x-3)^2} + \frac{x(x+2)}{(x+5)} \cdot \frac{(x+5)}{(x+2)(x-3)}$$

2 points

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

1 point

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

1 point

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

1 point

See examples 2-3 P. 58-59

and problems 15-38 P.62-63

7. [3-points] Factor completely over the integers: $3x^{5/2} - 9x^{3/2} + 6x^{1/2}$.

$$= 3x^{1/2} (x^2 - 3x + 2) \quad \underline{2 \text{ points}}$$

$$= 3x^{1/2} (x-1)(x-2) \quad \underline{1 \text{ point}}$$

See examples 1-5 P. 44-48

and problems 1-36 P. 53

8. [4-points] Factor completely over the integers: $x^3y^2 - 9x^3 - 8y^2 + 72$.

$$= x^3(y^2 - 9) - 8(y^2 - 9) \quad \underline{1 \text{ point}}$$

$$= (y^2 - 9)(x^3 - 8) \quad \underline{1 \text{ point}}$$

$$= (y-3)(y+3)(x-2)(x^2 + 2x + 4) \quad \underline{2 \text{ points}}$$

See example 9 P. 51

and problems 53-56 P. 54

9. [5-points] Write the complex number $\frac{\sqrt{-2}\sqrt{-8} + i^7}{1+i}$ in the standard form.

See example 3, 4, 5 = $\frac{(\sqrt{2}i)(\sqrt{8}i) + i^3}{1+i}$ 2 points

Page 67-71
and problems = $\frac{-4 - i}{1+i}$ 1 point

23, 24, 33-36
41-62 P. 72 = $\frac{(4-i)(1-i)}{(1+i)(1-i)}$ 1 point

$$= \frac{-5 + 3i}{2} = -\frac{5}{2} + \frac{3}{2}i \quad \underline{1 \text{ point}}$$

10. [5-points] Let $P = (3x^2 - 2x + 5)(2x^3 - 5x - 2)$.

(a) Write P as a polynomial in the standard form.

See examples 1, 3, 5
P. 36-39 and
Problems 11-16,
23-34, 63-70
P. 41 -

$$P = 6x^5 - 15x^3 + 6x^2 - 4x^4 + 10x^2 + 4x + 10x^3 - 25x - 10$$

$$= 6x^5 - 4x^4 - 5x^3 + 4x^2 - 21x - 10$$

2 points

(b) Find the leading coefficient of P . $= 6$ 1 point

(c) Find the coefficient of x in P . $= -21$ 1 point

(d) Evaluate P for $x = -1$.

The value $= -6 - 4 + 5 + 4 + 21 - 10 = +10$
1 point

11. [5-point] Simplify $\frac{xy^{-1} - x^{-1}y}{xy^{-1} + 1 - 2x^{-1}y}$. [Write the answer with positive exponents]

See examples
4, 5 P. 60-61
and Problems
41-62 P. 63

$$= \frac{\frac{x}{y} - \frac{y}{x}}{\frac{x}{y} + 1 - \frac{2y}{x}}$$

1 point

$$= \frac{x^2 - y^2}{x^2 + xy - 2y^2}$$

1 point

$$= \frac{(x-y)(x+y)}{(x-y)(x+2y)}$$

2 points

$$= \frac{x+y}{x+2y}$$

1 point