1. Let $U = \{2, 7, 11, 43, 13, 19, 1\}$, $A = \{2, 7, 13, 19\}$, $B = \{13, 43, 7, 1, 2\}$. Find $(A \cap B)'$.

A. $\{2, 7, 13\}$
B. $\{11, 43, 19, 1\}$
C. $\{11, 43, 13, 19, 1, 7, 2\}$
D. $\{1, 11, 43, 13, 19, 1, 7, 2\}$

$A \cap B = \{2, 7, 13\}$

$(A \cap B)' = \{11, 43, 19, 1\}$ (B)

---

2. The degree of the polynomial $(3x^3 - 2x^2 + 1)(x^2 - 3x + 5)$ is ...

A. 4
B. 5
C. 7
D. 3

$= 3x^5 - 9x^4 + 15x^3 - 2x^4 + 6x^3 - 10x^2 + x^2 - 3x + 5$

$= 3x^5 - 11x^4 + 21x^3 - 9x^2 - 3x + 5$ $\quad D = 5$ (B)

---

3. The degree of the polynomial $2(xyz)^3 + yx^7$ is ...

A. 9
B. 8
C. 7
D. 3

$= 2x^3y^3z^3 + yx^7$

$D = 9$ (A)

---

4. For $x \neq 0$, simplify the expression $-7x^0 + (-7x)^0 + 2^3 - (\frac{1}{2})^{-3}$

A. 12
B. 0
C. -2
D. -6

$= -7(1) + 1 + 8 - 8$

$= -6$ (D)

---

5. For $x \neq 0$ and $y \neq 0$, simplify $(3xy^{-2})^3(6x^{-2}y^{-3})^{-2}$

A. $\frac{3y^7}{4}$
B. $\frac{4y^{12}}{3}$
C. $\frac{3x^7}{4}$
D. $\frac{3y^{12}}{4}$

$= 27x^3y^{-6} \cdot \frac{x^4y^6}{6^2} = \frac{27}{36}x^7y^0 = \frac{3}{4}x^7$ (C)

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6. Find the domain of $\frac{12x}{(x^2+2)(x^2-1)}$

A. $\mathbb{R}$
B. $\mathbb{R} \setminus \{1, -1\}$
C. $\mathbb{R} \setminus \{1, -1, -2\}$
D. $\mathbb{R} \setminus \{1, -1, -\sqrt{2}, \sqrt{2}\}$

$(x^2+2)(x^2-1) = 0$

$x^2 + 2 = 0$ or $x^2 - 1 = 0$

$x^2 = -2$, $x^2 = 1$

$x = \pm i\sqrt{2} \notin \mathbb{R}$, $x = \pm 1$

$D = \mathbb{R} \setminus \{\pm 1\}$

(B)

---

7. Evaluate $9 + 2(80 - 9 \div 9 * 9^2)$

A. 7
B. 9
C. 8
D. 0

$= 9 + 2(80 - 9 \div 9 \cdot 81)$

$= 9 + 2(80 - 1 \cdot 81) =$

$= 9 + 2(80 - 81)$

$= 9 + 2(-1)$

$= 9 - 2 = 7$ (A)

---

8. Let $A = \{\frac{5}{8}, -3.\overline{2}, \frac{\pi}{8}, -4, \sqrt{64}, \sqrt{3}, \frac{12}{2}, 0\}$. List all the elements of A that belong to the set of rational numbers.

A. $\{\frac{5}{8}, -3.\overline{2}, -4, \sqrt{64}, \frac{12}{2}\}$

B. $\{-4, \sqrt{64}, \sqrt{3}, \frac{12}{2}, 0\}$

C. $\{\frac{5}{8}, \frac{\pi}{8}, \sqrt{3}, \frac{12}{2}, 0\}$

D. $\{\frac{5}{8}, -3.\overline{2}, -4, \sqrt{64}, \frac{12}{2}, 0\}$

---

9. Let $A = \{\frac{5}{8}, -3.\overline{2}, \frac{\pi}{8}, -4, \sqrt{64}, \sqrt{3}, \frac{12}{2}, 0\}$. List all the elements of A that belong to the set of natural numbers.

A. $\{\frac{5}{8}, -3.\overline{2}, -4, \sqrt{64}, \frac{12}{2}\}$

B. $\{-4, \sqrt{64}, \sqrt{3}, \frac{12}{2}, 0\}$

C. $\{\frac{5}{8}, \sqrt{3}, \frac{12}{2}, 0\}$

D. $\{\sqrt{64}, \frac{12}{2}\}$

---

10. Perform the indicated operations $(-2x^2 + 5x + 8) - (x^3 - 7x - 2) + 4x(x^2 - 3)$

A. $3x^3 - 2x^2 - 14x + 16$

B. $-5x^3 - 2x^2 - 14x + 16$

C. $5x^3 - 2x^2 - 14x + 16$

D. $3x^3 - 2x^2 + 10$

$= -2x^2 + 5x + 8 - x^3 + 7x + 2 + 4x^3 - 12x$

$= 3x^3 - 2x^2 + 10$ (D)

---

11. Perform the indicated operations $((x-2) - 3y)((x-2) + 3y)$

A. $x^2 + 4 - 9y^2$

B. $x^2 - 4 - 9y^2$

C. $x^2 - 4x - 4 - 9y^2$

D. $x^2 - 4x + 4 - 9y^2$

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

$= x^2 - 4x + 4 - 9y^2$

---

12. Write the rational expression in the lowest term $\frac{9 - 3x}{x^2 - 9}$

A. $\frac{-2}{x+3}$

B. $\frac{-2}{x-3}$

C. $\frac{-3}{x+3}$

D. $\frac{-3}{x-3}$

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

---

13. Perform the indicated operations $\frac{x^2+5x-14}{x^2-4} \div \frac{x^2+12x+35}{x^2+12x+20} = \ldots$

A. $\frac{x+10}{x+5}$
B. $\frac{x+5}{x+10}$
C. $\frac{x+1}{x+2}$
D. $\frac{x+2}{x+1}$

$= \frac{(x+7)(x-2)}{(x+2)(x-2)} \div \frac{(x+7)(x+5)}{(x+10)(x+2)}$

$= \frac{(x+7)}{(x+2)} \cdot \frac{(x+10)(x+2)}{(x+7)(x+5)} = \frac{(x+10)}{(x+5)}$ (A)

---

14. Perform the indicated operations $\frac{2x^3-3x^2-8x+12}{x-3}$

A. $2x^2+3x+1-\frac{15}{x-3}$
B. $2x^2-3x+1-\frac{15}{x-3}$
C. $2x^2+3x+1+\frac{15}{x-3}$
D. $2x^2-3x+1-\frac{15}{x-3}$

$x-3 \;\overline{)\; 2x^3-3x^2-8x+12}$ → $2x^2+3x+1$

$-2x^3+6x^2$

$3x^2-8x+12$

$-3x^2+9x$

$x+12$

$x-3$ → R = 15

(C)

---

15. The remainder of the division $\frac{x^2-3x+5}{x+1}$ is ...

A. 0
B. 5
C. 7
D. 9

$x+1 \;\overline{)\; x^2-3x+5}$ → $x-4$

$-x^2-x$

$-4x+5$

$+4x+4$

R = 9

(D)

---

16. The division of x^3+3x^2+3x+7 by $(x+2)$ is equivalent to

A. $x^3+3x^2+3x+7=(x+2)(x^2+x+1)+5$
B. $x^3+3x^2+3x+7=(x+2)(x^2+x-1)+5$
C. $x^3+3x^2+3x+7=(x+2)(x^2+x+1)-5$
D. $x^3+3x^2+3x+7=(x+2)(x^2-x+1)+5$

$x+2 \;\overline{)\; x^3+3x^2+3x+7}$ → x^2+x+1

$-x^3-2x^2$

x^2+3x+7

$-x^2-2x$

$x+7$

$x+2$ → R = 5

(A)

---

17. Let a be a real number. The remainder of the division $\frac{x^2-3x+3a}{x-a}$ is ...

A. a^2+a+2
B. a^2
C. $a+2$
D. a

$x-a \;\overline{)\; x^2-3x+3a}$ → $x+(a-3)$

$-x^2+ax$

$(a-3)x+3a$

$-(a-3)x+a(a-3)$

$3a+a^2-3a$ → R = a^2

(B)

18. Let $a > 0$. The distance between $2a$ and $-a$ is

A. a
B. $2a$
C. $3a$
D. 0

$d(2a,-a) = |2a-(-a)| = |3a| = 3a$ (C)

---

19. Dividing x^3+2x^2-x-2 by $x+2$ gives

A. x^2+1
B. x^2-1
C. x^2-2
D. x^2+2

$x+2 \;\overline{)\; x^3+2x^2-x-2}$

x^2-1

x^3+2x^2

$-x-2$

$-x-2$

$0 \quad 0$ (B)

---

20. Factor completely $75y^4-147y^2$

A. $3(5y^2+7)(5y^2-7)$
B. $3y^2(5y^2-7)^2$
C. $3y^2(5y+7)(5y-7)$
D. $3y(5y^2-7)^2$

$= 3y^2(25y^2-49)$

$= 3y^2(5y-7)(5y+7)$ (C)

---

21. Factor completely $x^2y-10y+xy^2-10x$

A. $(xy+10)(x-y)$
B. $(xy+10)(x+y)$
C. $(xy-10)(x+y)$
D. $(xy-10)(x-y)$

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

$= xy(x+y)-10(x+y)$

$(x+y)(xy-10)$ (C)

---

22. Find the domain of $\dfrac{1}{(x^2+2)(x^2+1)}$

A. $\mathbb{R}\setminus\{-1,-2\}$
B. $\mathbb{R}\setminus\{1,2\}$
C. $\mathbb{R}$
D. $\mathbb{R}\setminus\{-1,1,-\sqrt{2},\sqrt{2}\}$

Let $(x^2+2)(x^2+1)=0$

$x^2+2=0$ or $x^2+1=0$

$x=\pm i\sqrt{2} \notin \mathbb{R}$, $x=\pm i \notin \mathbb{R}$

$\therefore D = \mathbb{R}$ (C)

---

23. The solution of the equation $\dfrac{-2}{2x-1} = \dfrac{2}{2x+1}$ is

A. $x=-1$
B. $x=1$
C. ϕ
D. $x=0$

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

$-4x-2-4x+2=0$

$-8x=0 \Rightarrow x=0$ (D)

24. The solution set of the linear equation $4(5x+1) = -5-(3-20x)$ is

A. $S = \{-2\}$
B. $S = \{2\}$
C. $S = \phi$
D. $S = \mathbb{R}$

$20x + 4 = -5 - 3 + 20x$ (C)
$4 = -8$
S.S. $= \phi$ Contradiction Equation.

25. Give the solution of following equation $2x^2 + 2 = 0$

A. $x = -1$ and $x = 1$
B. $x = -i$ and $x = i$
C. ϕ
D. $x = i$ and $x = 1$

$2x^2 = -2$
$x^2 = -1$
$x = \pm i$ (B)

26. Let $a > 2$ be a real number. Give the solution of following equation $x^2 + ax + (a-1) = 0$

A. $x = -1$ and $x = 1+a$
B. $x = -1$ and $x = 1-a$
C. ϕ
D. $x = -1$ and $x = a$

$x^2 + ax + (a-1) = 0$
$(x + a - 1)(x + 1) = 0$
$x + a - 1 = 0$, $x = 1 - a$ / $x + 1 = 0$, $x = -1$ (B)

27. Let b be a real number. Give the value of b such that the equation $2x^2 + bx + 2 = 0$ admits exactly one (double) positive solution.

A. $b = -4$
B. $b = 4$
C. $b = -2$
D. $b = 2$

$2x^2 + bx + 2 = 0$
$a = 2, b = b, c = 2$
$D = b^2 - 4(2)(2) = 0$
$b^2 - 16 = 0$
$b^2 = 16$
$b = \pm 4$
① $b = +4$ one double negative solution
② $b = -4$ (Positive)

28. Let c be a real number. Give the value of c such that the equation $x^2 + 4x + c = 0$ admits exactly one (double) solution.

A. $c = -4$
B. $c = -2$
C. $c = 2$
D. $c = 4$

$x^2 + 4x + c = 0$
$a = 1, b = 4, c = c$
$D = b^2 - 4ac = 16 - 4(1)(c) = 0$
$\therefore 4c = 16$
$c = 4$ (D)

29. Simplify the following exponent i^{2030}

A. 1
B. -1
C. $-i$
D. i

$\frac{2030}{4} = 507.5$
$\therefore i^{2030} = i^2 = -1$ (B)

30. Simplify the following exponent $(-1)^{2018} i^{1439}$

A. 1
B. -1
C. $-i$
D. i

$(-1)^{2018}\, i^{1439} = i^{1439} = i^3 = -i$
$\frac{1439}{4} = 359.75$

31. Simplify the following term $\frac{\sqrt{-32}\sqrt{-2}}{8}$

A. i
B. $-i$
C. -1
D. 1

$= \frac{i\sqrt{32}\cdot i\sqrt{2}}{8} = \frac{i^2\sqrt{64}}{8}$

$= -1.\frac{8}{8} = -1$ (C)

---

32. The quotient $\frac{1+2i}{1-i}$ in standard form $a+bi$ is ...

A. $-\frac{1}{2}+\frac{3}{2}i$
B. $-\frac{1}{2}-\frac{3}{2}i$
C. $\frac{1}{2}-\frac{3}{2}i$
D. $\frac{1}{2}+\frac{3}{2}i$

$= \frac{1+2i}{1-i}\cdot\frac{1+i}{1+i}$ $\quad i^2=-1$

$= \frac{1+i+2i+2i^2}{(1)^2+(1)^2}$

$= \frac{-1+3i}{2}$

$= -\frac{1}{2}+\frac{3}{2}i$ (A)

---

33. The solution set of the following equation: $(x+2)^2=-4$ is

A. $\{-2i\pm\sqrt{2}\}$
B. $\{-2\pm 2i\}$
C. $\{2i\pm\sqrt{2}\}$
D. $\{2\pm 2i\}$

$x+2 = \pm\sqrt{-4}$

$x+2 = \pm 2i$

$x = -2\pm 2i$ (B)

---

34. The solution set of the following quadratic equation: $x^2+100=-20x$ is

A. $\{-10,10\}$
B. $\{10\}$
C. $(-10,10)$
D. $\{-10\}$

$x^2+20x+100=0$

$(x+10)(x+10)=0$

$x+10=0$, $x+10=0$

$x=-10,-10$

$S.S=\{-10\}$ (D)
double solution.

---

35. Solve the following quadratic equation: $(x+k)^2+9=5$.

A. $x=k\pm 2i$
B. $x=-k\pm 2i$
C. $x=-k\pm 4i$
D. $x=k\pm 4i$

$(x+k)^2 = 5-9 = -4$

$\sqrt{(x+k)^2} = \pm\sqrt{-4}$

$x+k = \pm 2i$

$x = -k\pm 2i$ (B)