

Show all necessary steps clearly, neatly, and systematically to receive full credit.

1. (1) Write in scientific notation: 456,700,000.

$$4.567 \times 10^8$$

2. (1) Write in standard notation: 9.53×10^{-5} .

$$0.0000953$$

3. (1) Multiply: $-a^2b^2(-a^4b^2 + a^3 + b^3 - ab^4 + 7a)$.

$$= a^6b^4 - a^5b^2 - a^2b^5 + a^3b^6 - 7a^3b^2$$

4. (1) Factor completely: $-5ab^2 + 10a^2b - 15ab$.

$$= -5ab(b - 2a + 3)$$

5. (1) Factor completely: $4(x-2) - x(x-2)$.

$$= (x-2)(4-x)$$

6. (1) Factor completely: $x^2 + 2x - 24$.

$$= (x-4)(x+6)$$

7. (1) Factor completely: $x^2 - 18x + 40$.

$$= \text{prime}$$

8. (1) Factor completely: $x^2 - 14x + 45$.

$$= (x-5)(x-9)$$

9. (1) Factor completely: $x^2 + 36$.

$$= \text{prime}$$

10. (2) Factor completely: $x^2 - 169$.

$$\begin{aligned} &= (x)^2 - (13)^2 \\ &= (x-13)(x+13) \end{aligned}$$

11. (2) Factor completely: $10y + 9 + y^2$.

$$\begin{aligned} &= y^2 + 10y + 9 \\ &= (y+1)(y+9) \end{aligned}$$

12. (2) Factor completely: $p^3 - 27$.

$$\begin{aligned} &= (p)^3 - (3)^3 \\ &= (p-3)(p^2 + 3p + 9) \end{aligned}$$

13. (2) Factor completely: $35y^2 + 11y - 10$.

$$= (5y-2)(7y+5)$$

14. (2) Factor completely: $3xy + 18x - 5y - 30$.

$$\begin{aligned} &= 3x(y+6) - 5(y+6) \\ &= (y+6)(3x-5) \end{aligned}$$

15. (2) Factor completely: $49u^2 - 121v^2$.

$$\begin{aligned} &= (7u)^2 - (11v)^2 \\ &= (7u-11v)(7u+11v) \end{aligned}$$

16. (2) Factor completely: $z^3 + 216$.

$$\begin{aligned} &= (z)^3 + (6)^3 \\ &= (z+6)(z^2 - 6z + 36) \end{aligned}$$

17. (2) Multiply: $(17x-13y)(17x+13y)$.

$$\begin{aligned} &= (17x)^2 - (13y)^2 \\ &= 289x^2 - 169y^2 \end{aligned}$$

18. (2) Multiply: $(2r^2 - 9)^2$.

$$= (2r^2)^2 - 2(2r^2)(9) + (9)^2$$

$$= 4r^4 - 36r^2 + 81$$

19. (2) Subtract:

$$(7.1a^2 + 2.2ab - 5.8) - (3.4a^2 - 3.9ba + 11.8)$$

$$= \underline{7.1a^2} + \underline{2.2ab} - 5.8 - \underline{3.4a^2} + \underline{3.9ba} - 11.8$$

$$= 3.7a^2 + 6.1ab - 17.6$$

20. (2) Divide: $\frac{15a^5b + ab^2 - 25b}{5a^2b}$.

$$= \frac{15a^5b}{5a^2b} + \frac{ab^2}{5a^2b} - \frac{25b}{5a^2b}$$

$$= 3a^3 + \frac{b}{5a} - \frac{5}{a^2}$$

21. (3) Factor completely: $8at^2 - 32a$.

$$= 8a(t^2 - 4)$$

$$= 8a(t - 2)(t + 2)$$

22. (3) Factor completely: $18p^3 - 33p^2 - 6p$.

$$= 3p(6p^2 - 11p - 2)$$

$$= 3p(p - 2)(6p + 1)$$

23. (3) Factor completely: $x^4 - 81$.

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

$$= (x^2 - 9)(x^2 + 9)$$

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

24. (4) Factor completely:

$$4m^2n + 12m^2 - 8mn - 24m$$

$$= 4m[mn + 3m - 2n - 6]$$

$$= 4m[m(n + 3) - 2(n + 3)]$$

$$= 4m \cdot (n + 3)(m - 2)$$

25. (4) Simplify: $(35x^4y^{-7}z)\left(\frac{1}{7}x^{-9}y^{11}z^4\right)$.

$$= 35 \cdot \frac{1}{7} \cdot x^{4+(-9)} \cdot y^{-7+11} \cdot z^{1+4}$$

$$= 5x^{-5}y^4z^5$$

$$= \frac{5y^4z^5}{x^5}$$

26. (4) Simplify: $\frac{28x^{-7}y^{14}z^{-11}}{49x^5y^{-8}z^{-3}}$.

$$= \frac{4x^{-7-5}y^{14-(-8)}z^{-11-(-3)}}{7}$$

$$= \frac{4x^{-12}y^{22}z^{-8}}{7}$$

$$= \frac{4y^{22}}{7x^{12}z^8}$$

27. (4) Divide: $(15x^2 - 8x - 8) \div (3x + 2)$.

$$3x + 2 \overline{) 15x^2 - 8x - 8}$$

$$-\underline{(\ominus 15x^2 \oplus 10x)}$$

$$-18x - 8$$

$$-\underline{(\oplus 18x \oplus 12)}$$

$$4$$

$$5x - 6 + \frac{4}{3x + 2}$$

28. (4) Solve: $144x^2 = 25$.

$$144x^2 - 25 = 0$$

$$(12x - 5)(12x + 5) = 0$$

$$\begin{array}{l|l} 12x - 5 = 0 & 12x + 5 = 0 \\ 12x = 5 & 12x = -5 \\ x = \frac{5}{12} & x = -\frac{5}{12} \end{array}$$

$$\left\{ -\frac{5}{12}, \frac{5}{12} \right\}$$

29. (4) Solve: $2x - x^2 = -24$.

$$0 = x^2 - 2x - 24$$

$$0 = (x + 4)(x - 6)$$

$$\begin{array}{l|l} x + 4 = 0 & x - 6 = 0 \\ x = -4 & x = 6 \end{array}$$

$$\{-4, 6\}$$

30. (6) Divide: $(-13x - 4 + 9x^3) \div (3x + 1)$.

$$\begin{array}{r} 3x^2 - x - 4 \\ 3x + 1 \overline{) 9x^3 + 0x^2 - 13x - 4} \\ \underline{-(9x^3 + 3x^2)} \\ -3x^2 - 13x - 4 \\ \underline{-(-3x^2 - x)} \\ -12x - 4 \\ \underline{-(-12x - 4)} \\ 0 \end{array}$$

$$3x^2 - x - 4$$

31. (6) Solve: $2p^3 = 2p(p+2)$.

$$2p^3 = 2p^2 + 4p$$

$$2p^3 - 2p^2 - 4p = 0$$

$$2p(p^2 - p - 2) = 0$$

$$2p(p+1)(p-2) = 0$$

$$\begin{array}{l|l|l} 2p = 0 & p+1 = 0 & p-2 = 0 \\ p = 0 & p = -1 & p = 2 \end{array}$$

$$\{-1, 0, 2\}$$

32. (6) Solve: $(x+8)(x-3) = -30$.

$$x^2 - 3x + 8x - 24 = -30$$

$$x^2 + 5x - 24 = -30$$

$$x^2 + 5x + 6 = 0$$

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

$$\begin{array}{l|l} x+2 = 0 & x+3 = 0 \\ x = -2 & x = -3 \end{array}$$

$$\{-3, -2\}$$

33. (3) Simplify: $(-2x^{-3}y^4z^{-5})^{-2}$

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

$$= \frac{x^6 y^{-8} z^{10}}{(-2)^2}$$

$$= \frac{x^6 z^{10}}{4 y^8}$$

34. (6) The formula $h = -16t^2 + 80t + 96$ describes the rocket's height, h in feet, t second after it was launched. How long will it take the rocket to reach the ground?

$$h = -16t^2 + 80t + 96$$

$$0 = -16t^2 + 80t + 96$$

$$0 = -16(t^2 - 5t - 6)$$

$$0 = -16(t + 1)(t - 6)$$

$$\begin{array}{l|l} t + 1 = 0 & t - 6 = 0 \\ t \cancel{-} -1 & t = 6 \end{array}$$

it will take 6 second.

35. (7) The length of a rectangular garden is 6 ft longer than its width. If the area of the garden is 55 ft^2 , find its length and its width.

① measure of length = $x + 6$
measure of width = x

② $(x + 6) \cdot x = 55$
 $x^2 + 6x = 55$

$$x^2 + 6x - 55 = 0$$

$$(x - 5)(x + 11) = 0$$

$$\begin{array}{l|l} x - 5 = 0 & x + 11 = 0 \\ x = 5 & x \cancel{-} -11 \end{array}$$

③ measure of length is 11 ft,
" width is 5 ft.