

Concept 1: Functions

Given $f(x) = 3x - 4$; $g(x) = x^2$; $h(x) = 2x^2 + 1$

1. $(f \circ g)(x)$
 $(g(x)) = x^2$
 $-(x^2) = 3(x^2) - 4$
 $3x^2 - 4$

2. $(g \circ h)(-2)$
 $g(h(-2))$
 $2(-2)^2 + 1 = 2(4) + 1 = 2(4) + 1 = 9$
 $g(9) = 81$

3. $(f - g)(x) + 3[h(x)]$
 $3x - 4 - x^2 + 3(2x^2 + 1)$
 $3x - 4 - x^2 + 6x^2 + 3$
 $5x^2 + 3x - 1$

4. $\frac{f(3) - h(5)}{[g(2)]^2}$
 $f(3) = 3(3) - 4 = 5$
 $h(5) = 2(5)^2 + 1 = 2(25) + 1 = 51$
 $g(2) = 4$
 $\frac{5 - 51}{4^2} = \frac{-46}{16} = \frac{-23}{8}$

Concept 2: Solving Linear Equations

Solve for x

5. $\frac{5}{4}x - \frac{1}{2} = \frac{2}{3} - 3x$

6. $\frac{1}{5}x + 4 = 3x - \frac{7}{10}$

7. $\frac{3}{2}x + \frac{2}{9} = \frac{5}{6} - \frac{7}{3}x$

Concept 3: Solving Systems of Equations

8. Solve for $3x + 2y$ given: $\begin{cases} 5x - 3y = 23 \\ 2x + y = 7 \end{cases}$

9. Solve for $2x - y + z$ given: $\begin{cases} 3x + 6y - 2z = -6 \\ 2x + y + 4z = 19 \\ -5x - 2y + 8z = 62 \end{cases}$

Concept 4: Graphing Functions

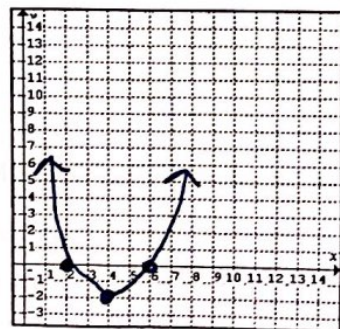
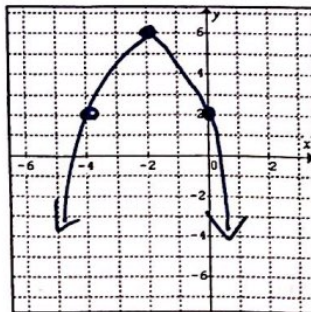
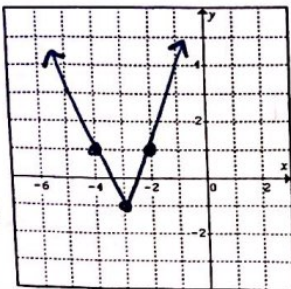
Graph the following on the given x-y plane

$\frac{-b}{2a} = \frac{-(-4)}{2(-1)} = \frac{4}{-2} = -2$

10. $y = 2|x + 3| - 1$

11. $y = -x^2 - 4x + 2$

12. $y = \frac{1}{2}(x - 2)(x - 6)$
 $\frac{1}{2}(4 - 2)(4 - 6)$
 $\frac{1}{2}(2)(-2)$



$y = -(-2)^2 - 4(-2) + 2$
 $-4 + 8 + 2 = 4 + 2 = 6$

Concept 5: Simplifying Imaginary Numbers

13. i^{4231}

$-i$

$$\begin{array}{r} 1057 \\ 4 \overline{) 414231} \\ \underline{023} \\ 20 \\ \underline{31} \\ 28 \end{array}$$

14. $-4i^{13} \cdot 2i^{23} \cdot 3i^{19}$

$$\begin{array}{l} -24i^{55} \\ -24(-i) = 24i \end{array}$$

15. $6\sqrt{-9} + 5\sqrt{25} - 7\sqrt{-16}$
 $6(3i) + 5(5) - 7(4i)$
 $18i + 25 - 28i$

$25 - 10i$

$$\begin{array}{r} 16 \\ 4 \overline{) 66} \\ \underline{4} \\ 26 \\ \underline{24} \\ 2 \end{array}$$

$$\begin{array}{r} 33 \\ 32 \\ \hline 65 \end{array}$$

16. $(2i^{11})^3 \cdot (i^8)^4 \cdot 3i$
 $8i^{33} \cdot i^{32} \cdot 3i$
 $24i^{66}$

-24

Concept 6: Finding zeros/roots/solutions of a function

Find the zeros/roots/solutions (real and/or complex) for the following polynomial functions using any technique.

17. $3x^2 - 18x = 0$
 $3x(x-6) = 0$

$x=0, x=6$

18. $2v^2 + 3v - 5 = 0$
 $(2v+5)(v-1) = 0$

$v = -5/2, v = 1$

19. $81 - 4y^2 = 0$
 $(9-2y)(9+2y) = 0$

$y = 9/2, -9/2$

20. $x^2 + 5x = 2$
 $x^2 + 5x - 2 = 0$

$$x = \frac{-5 \pm \sqrt{25 - 4(1)(-2)}}{2(1)} = \frac{-5 \pm \sqrt{25+8}}{2} = \frac{-5 \pm \sqrt{33}}{2}$$

21. $x^2 + 7x + 8 = 0$
 $x = \frac{-7 \pm \sqrt{49 - 4(1)(8)}}{2(1)}$

$$x = \frac{-7 \pm \sqrt{49-32}}{2} = \frac{-7 \pm \sqrt{17}}{2}$$

22. $5n = 12 - 2n^2$
 $2n^2 + 5n + 12 = 0$

$$\frac{-5 \pm \sqrt{25 - 4(2)(12)}}{2(2)} = \frac{-5 \pm i\sqrt{71}}{4}$$

$$\frac{-5 \pm \sqrt{25-96}}{4} = \frac{-5 \pm \sqrt{-71}}{4}$$

Concept 7: Factoring Polynomials

Factor completely.

23. $a^3 + 64$
 $(a+4)(a^2-4a+16)$

24. $4 - 49y^2$
 $(2-7y)(2+7y)$

25. $c^4 - 625$
 $(c^2-25)(c^2+25)$
 $(c-5)(c+5)(c^2+25)$

26. $64h^2 - 25k^2$
 $(8h-5k)(8h+5k)$

27. $2n^2 + 8n - 42$
 $2(n^2 + 4n - 21)$
 $2(n+7)(n-3)$

28. $3w^2 + 11w - 4$
 $(3w-1)(w+4)$

29. $n^2 - 4mn + 4m^2$
 $(n-2m)(n+2m)$

30. $48v^4 - 243$
 $3(16v^4 - 81)$
 $3(4v^2-9)(4v^2+9)$

Concept 8: Operations of Polynomials

Simplify the following. Use synthetic division on #32 and long division on #33

31. $\frac{4a^3b - 6ab + 2ab^2}{2ab}$

32. $\frac{5x^2 + 10x + 17 + \frac{39}{x-2}}{x-2}$

$$\begin{array}{r} 2 \overline{) 5 \quad 0 \quad -3 \quad 5} \\ \underline{10} \quad \underline{20} \quad \underline{34} \\ 5 \quad 10 \quad 17 \quad 39 \end{array}$$

33. $\frac{x^3 - 2x^2 + x + 2 - \frac{2}{3x+1}}{(3x^4 - 5x^3 + x^2 + 7x) \div (3x+1)}$

$$\begin{array}{r} x^3 - 2x^2 + x + 2 \\ 3x+1 \overline{) 3x^4 - 5x^3 + x^2 + 7x} \\ \underline{-(3x^4 + x^3)} \\ -6x^3 + x^2 + 7x \\ \underline{-(-6x^3 + 2x^2)} \\ -3x^2 + 7x \\ \underline{-(-3x^2 + x)} \\ -2x + 2 \\ \underline{-(-2x + 2)} \\ 0 \end{array}$$

Concept 9: Simplifying Complex Numbers

Simplify the following

34. $(3+2i) - 4(-5+4i)$
 $3+2i+20-16i$
 $23-14i$

35. $\frac{3}{(7-2i)(7+2i)}$
 $\frac{21+6i}{49-4i^2} = \frac{21+6i}{53}$

36. $(2+4i)(5-6i)$
 $10-12i+20i-24i^2$
 $10+8i+24$
 $34+8i$

Concept 10: Simplifying Complex Numbers

Simplify leaving only positive exponents.

$$37. \frac{(m^4)^{-1}}{9m^3} \frac{m^{-4}}{9m^3}$$

$$\boxed{\frac{1}{9m^7}}$$

$$38. (3a^{-2})^3 (a^3)^{-4}$$

$$27a^{-6} \cdot a^{-12}$$

$$27a^{-18} = \boxed{\frac{27}{a^{18}}}$$

$$39. \left(\frac{p^{-2}}{2p^4}\right)^3 \frac{p^{-6}}{8p^{12}} \boxed{\frac{1}{8p^{18}}}$$

$$40. (7x^5y^3z^{-9})^0$$

$$\boxed{1}$$

$$41. \frac{(2m^2p^3)(m^2p)^{-2}}{(-3mp^4)^0(2m^3p^4)^3}$$

$$\frac{2m^2p^3 \cdot m^{-4}p^{-2}}{8m^9p^{12}}$$

$$\frac{2m^{-2}p}{8m^9p^{12}} = \boxed{\frac{1}{4m^{11}p^{11}}}$$

$$42. \left(\frac{8x^4y^{-3}z^2}{12xy^{-7}z^6}\right)^{-3}$$

$$\left(\frac{12xy^{-7}z^6}{8x^4y^{-3}z^2}\right)^3 = \left(\frac{3z^4}{2x^3y^4}\right)^3$$

$$\boxed{\frac{27z^{12}}{8x^9y^{12}}}$$

Concept 11: Simplifying expressions using rational exponents and radicals

Simplify

$$43. \sqrt[3]{64x^7y^{14}z^{23}}$$

$$\boxed{4x^2y^4z^3\sqrt[3]{xyz^2}}$$

$$44. (50x^7y^4z)^{1/2}$$

$$\sqrt{50x^7y^4z}$$

$$\boxed{5x^3y^2\sqrt{2xz}}$$

$$45. \sqrt[4]{-32a^4b^7}$$

$$\sqrt[4]{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2a^4b^7}$$

$$\boxed{-2a|b|\sqrt[4]{2b^3}}$$

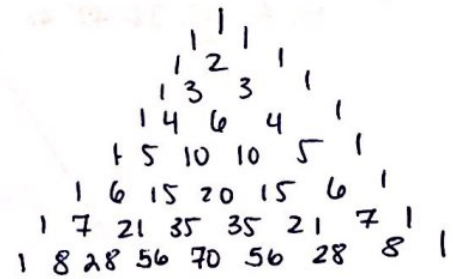
$$46. \sqrt[5]{-32r^{10}s^{12}t^4}$$

$$\boxed{-2r^2s^2\sqrt[5]{s^2t^4}}$$

Concept 12: Pascal's Triangle and Binomial Theorem

Solve

47. Write out the first 8 rows of Pascal's Triangle



48. Find the 5th term of $(2a+b)^5$

$$5(2a)^4(b)^1$$

$$\boxed{10a^4b}$$

49. Find the 3rd term of $(2x+3y)^4$

$$6(2x)^2(3y)^2$$

$$6(4x^2)(9y^2)$$

$$\boxed{216x^2y^2}$$

50. Expand and simplify $(2y-3)^6$

52. Find the coefficient of the 5th term in $(a+b)^8$

$$1(2y)^6 + 6(2y)^5(-3) + 15(2y)^4(-3)^2 + 20(2y)^3(-3)^3 + 15(2y)^2(-3)^4 + 6(2y)(-3)^5 + 1(-3)^6 \quad \boxed{70}$$

$$\boxed{64y^6 - 576y^5 + 2160y^4 - 4320y^3 + 4860y^2 - 2916y + 729}$$