**** ΙΔΙΩΤΙΚΟ ΓΥΜΝΑΣΙΟ ΔΟΥΡΑΧΑΝΗΣ ****
*** Τηλ. 26510 52247 ΔΟΥΡΑΧΑΝΗ ΙΩΝΝΙΝΑ ***
** ΜΑΘΗΜΑΤΙΚΑ Γ΄ ΓΥΜΝΑΣΙΟΥ **
* ΠΑΡΑΓΟΝΤΟΠΟΙΗΣΗ ΑΣΚΗΣΕΙΣ *

ΠΑΡΑΓΟΝΤΟΠΟΙΗΣΗ
ΑΣΚΗΣΕΙΣ

Να γίνει γινόμενο παραγόντων:

1) $60x^3\psi - 24x^3\psi^2 - 36x^2\psi^2$
2) $45\alpha^3x^4 - 30\alpha^3x^3 - 15\alpha^2x^3$
3) $x^2 - 49$
4) $4x^2 - 1$
5) $9 - 16x^2\psi^6$
6) $12x^3 - 108x$
7) $150\alpha x^6 - 54\alpha x^4\psi^2$
8) $15\alpha^2x - 1215\alpha^6x\psi^2$
9) $36\alpha^2x^4 - 16\alpha^4x^6$
10) $2x\left(9x^2-1\right)+5\left(9x^2-1\right)$
11) $4x^2\left(9x^2-16\right)-25\left(9x^2-16\right)$
12) $4x^2\left(25x^2-9\psi^2\right)-5x\left(25x^2-9\psi^2\right)+7\left(25x^2-9\psi^2\right)$
13) $2x^2 - 6x\psi - 3ax + 9a\psi$
14) $2x^2 - 6\beta x + 3ax - 9a\beta$
15) $2\alpha x^2 - 4\beta x^2 + 3a\psi^2 - 6\beta\psi^2$
16) $4\alpha x^2 - 8\beta x^2 - 9a\psi^2 + 18\beta\psi^2$
17) $3x^5 - 3a^4x - 2ax^4 + 2a^5$
18) $72ax^4 - 18a^3x^2 - 96a^2x^3 + 24a^4x$
19) $144ax^4 + 36a^3x^2 - 192a^2x^3 - 48a^4x$

20) x^3-125

21) $1-x^3$

22) $27-8x^3$

23) $64x^3-27\psi^3$

24) x^3+64

25) $8x^3+27$

26) $8x^3+27\psi^3$

27) $4x^5-108x^2$

28) $-56ax^7-7ax^4$

29) $x^3\left(4x^2-9\right)^3+8\left(4x^2-9\right)$

30) $x^3\left(9x^2+4\right)^3-27\left(9x^2+4\right)$

31) $9x^4\psi\left(8x^3-\psi^3\right)-3x^3\psi^2\left(8x^3-\psi^3\right)-15x^2\psi^3\left(\psi^3-8x^3\right)$

32) $9x^5-72x^2-4x^3\psi^2+32\psi^2$

33) $x^2+8x+16$

34) $x^2-16x+64$

35) $9x^2-30x+25$

36) $49x^2+16\psi^2+56x\psi$

37) $-36x^2-121\psi^2+132x\psi$

38) $16x^2-12x+\frac{9}{4}$

39) $25-15x+\frac{9x^2}{4}$

40) $-\frac{25x^2}{36}-16\psi^2+\frac{20x\psi}{3}$

41) $100x^{10}-180x^5\psi^3\omega^7+81\psi^6\omega^{14}$

42) $-16\alpha^8-24\alpha^4\beta^2-9\beta^4$

43) $\frac{25x^8}{16}+\frac{5x^4}{2}+1$

44) $x^3+6x^2+12x+8$

45) $64-48x+12x^2-x^3$

46) $64-144x+108x^2-27x^3$

47) $x^3+15x^2+75x+125$

48) $8x^9+36x^7+54x^5+27x^3$

49) $27x^9-108x^{13}+144x^{17}-64x^{21}$

50) $x^2-2x\psi+\psi^2-a^2$

51) $\omega^2-x^2+2x\psi-\psi^2$

52) $25x^2-20x\psi+4\psi^2-16\beta^2$

53) $9\omega^2-4x^2+4x\psi-\psi^2$

54) $25\psi^2-4x^2-12x-9$

55) $9\psi^2-4x^2+\alpha^2-20x-6\alpha\psi-25$

56) $4x^2-9\psi^2+\beta^2-\alpha^2-2\left(2\beta x-3\alpha\psi\right)$

57) $16\alpha^2-9x^4+4\beta^2-\psi^2-16\alpha\beta+6x^2\psi$

58) x^2-5x+6
59) $x^2+8x+12$
60) $x^2+4x-12$
61) $x^2-7x-18$
62) $-x^2-3x+4$
63) $-x^2+5x-4$
64) $-x^2-7x-10$
65) $2x^2-3x-5$
66) $3x^2+x-10$
67) $3x^2+10x+3$
68) $4x^2-9x+5$
69) $-2x^2-x+3$
70) $-4x^2-5x+21$
71) $6x^2-5x+1$
72) $9x^2+21x+10$
73) $6x^2+7x-3$
74) $8x^2-6x-9$
75) $12x^2+13x-4$
76) $6x^2+23x+20$
77) $-6x^2-x+12$
78) $-10x^2+23x-12$
79) $-12x^2-x+6$
80) $-15x^2+26x-8$
81) $-24x^5+28x^4+12x^3$
82) $-60x^7-5x^6+30x^5$
83) $2x^6-6x^5-20x^4$
84) $(3x-1)^2-2x(2x-5)-10$
85) $(2x-3)^2-3(x+2)(x-2)+8x-33$
86) $(3x-4)^2-2(3x-4)-8$
87) $(4x+5)^2+7(4x+5)+12$
88) x^4-26x^2+25
89) x^4+5x^2+49
90) $4x^4-13x^2+9$
91) $9x^4-25x^2+16$
92) $-25x^4-71x^2-64$
93) $-12x^5\psi^2+87x^3\psi^4-75x\psi^6$
94) $(3x^3-12x)(18x-2x^4)(x^4-5x^2+4)$
95) $(4x-4x^4)(4x^2-4x-3)$
96) $x^4+3x^3-4x-12$
97) $2x^3-x^2-12x-9$
98) $6x^3-5x^2-29x+10$
99) $x^3-12x+16$
100) $x^4-11x^2-18x-8$
101) $x^4+3x^3-12x^2-20x+48$
102) $2x^5+5x^4-27x^3-28x^2+116x-48$
103) $3x^5+x^4-33x^3-65x^2-42x-8$
104) $x^6-20x^4-18x^3+91x^2+162x+72$
105) $-2x^6-6x^5+24x^4+40x^3-96x^2$
106) $-6x^8-15x^7+81x^6+84x^5-348x^4+144x^3$
107) $-15x^9-5x^8+165x^7+325x^6+210x^5+40x^4$
108) $-2x^7+40x^5+36x^4-182x^3-324x^2-144x$
109) $-4x^7+28x^6-144x^4$
110) $-5x^6+60x^4+80x^3$
111) $-2x^6-6x^5+2x^4+22x^3+24x^2+8x$

1) $60x^3\psi - 12x^3\psi^2 - 36x^2\psi^2 = 12x^2\psi\left(5x - x\psi - 3\psi\right)$

2) $45\alpha^3x^4 - 30\alpha^3x^3 - 15\alpha^2x^3 = 15\alpha^2x^3\left(3\alpha x - 2\alpha - 1\right)$

3) $x^2 - 49 = x^2 - 7^2 = \left(x+7\right)\left(x-7\right)$

4) $4x^2 - 1 = \left(2x\right)^2 - 1^2 = \left(2x+1\right)\left(2x-1\right)$

5) $9 - 16x^2\psi^6 = 3^2 - \left(4x\psi^3\right)^2 = \left(3+4x\psi^3\right)\left(3-4x\psi^3\right)$

6)

$$12x^3 - 108x = 12x\left(x^2 - 9\right) = 12x\left(x^2 - 3^2\right) =$$

$$= 12x\left(x+3\right)\left(x-3\right)$$

7)

$$150\alpha x^6 - 54\alpha x^4\psi^2 = 6\alpha x^4\left(25x^2 - 9\psi^2\right) = 6\alpha x^4\left[\left(5x\right)^2 - \left(3\psi\right)^2\right] =$$

$$= 6\alpha x^4\left(5x+3\psi\right)\left(5x-3\psi\right)$$

8)

$$15\alpha^2x - 1215\alpha^6x\psi^2 = 15\alpha^2x\left(1 - 81\alpha^4\psi^2\right) = 15\alpha^2x\left[1^2 - \left(9\alpha^2\psi\right)^2\right] =$$

$$= 15\alpha^2x\left(1+9\alpha^2\psi\right)\left(1-9\alpha^2\psi\right)$$

9)

$$36\alpha^2x^4 - 16\alpha^4x^6 = 4\alpha^2x^4\left(9 - 4\alpha^2x^2\right) = 4\alpha^2x^4\left[3^2 - \left(2\alpha x\right)^2\right] =$$

$$= 4\alpha^2x^4\left(3+2\alpha x\right)\left(3-2\alpha x\right)$$

10)

$$2x\left(9x^2 - 1\right) + 5\left(9x^2 - 1\right) = \left(9x^2 - 1\right)\left(2x+5\right) =$$

$$= \left(2x+5\right)\left[\left(3x\right)^2 - 1^2\right] = \left(2x+5\right)\left(3x+1\right)\left(3x-1\right)$$

11)

$$4x^2\left(9x^2 - 16\right) - 25\left(9x^2 - 16\right) = \left(9x^2 - 16\right)\left(4x^2 - 25\right) =$$

$$= \left[\left(3x\right)^2 - 4^2\right]\left[\left(2x\right)^2 - 5^2\right] = \left(3x+4\right)\left(3x-4\right)\left(2x+5\right)\left(2x-5\right)$$

12)

$$4x^2\left(25x^2-9\psi^2\right)-5x\left(25x^2-9\psi^2\right)+7\left(25x^2-9\psi^2\right)=$$

$$=\left(25x^2-9\psi^2\right)\left(4x^2-5x+7\right)=$$

$$=\left[\left(5x\right)^2-\left(3\psi\right)^2\right]\left(4x^2-5x+7\right)=$$

$$=\left(5x+3\psi\right)\left(5x-3\psi\right)\left(4x^2-5x+7\right)$$

13)

$$2x^2-6x\psi-3ax+9a\psi=\ldots=\left(x-3\psi\right)\left(2x-3a\right)$$

14) $2x^2-6\beta x+3ax-9a\beta=\ldots=\left(x-3\beta\right)\left(2x+3a\right)$

15) $2\alpha x^2-4\beta x^2+3a\psi^2-6\beta\psi^2=\ldots=\left(\alpha-2\beta\right)\left(2x^2+3\psi^2\right)$

16)

$$4\alpha x^2-8\beta x^2-9a\psi^2+18\beta\psi^2=\ldots=4x^2\left(\alpha-2\beta\right)-9\psi^2\left(\alpha-2\beta\right)=$$

$$=\left(\alpha-2\beta\right)\left(4x^2-9\psi^2\right)=\left(\alpha-2\beta\right)\left(2x+3\psi\right)\left(2x-3\psi\right)$$

17)

$$3x^5-3a^4x-2ax^4+2a^5=3x\left(x^4-a^4\right)-2a\left(x^4-a^4\right)=$$

$$=\left(3x-2a\right)\left(x^4-a^4\right)=\left(3x-2a\right)\left(x^2+a^2\right)\left(x+a\right)\left(x-a\right)$$

18)

$$72ax^4-18a^3x^2-96a^2x^3+24a^4x=6ax\left(12x^3-3a^2x-16ax^2+4a^3\right)=$$

$$=6ax\left[3x\left(4x^2-a^2\right)-4a\left(4x^2-a^2\right)\right]=$$

$$=6ax\left(4x^2-a^2\right)\left(3x-4a\right)=6ax\left(2x+a\right)\left(2x-a\right)\left(3x-4a\right)$$

19)

$$144ax^4+36a^3x^2-192a^2x^3-48a^4x=12ax\left(12x^3+3a^2x-16ax^2-4a^3\right)=$$

$$=12ax\left[3x\left(4x^2+a^2\right)-4a\left(4x^2+a^2\right)\right]=$$

$$=12ax\left(4x^2+a^2\right)\left(3x-4a\right)$$

20)

$$x^3-125=x^3-5^3=(x-5)\left(x^2+5x+5^2\right)=$$
$$=(x-5)\left(x^2+5x+25\right)$$

21)

$$1-x^3=1^3-x^3=(1-x)\left(1^2+1.x+x^2\right)=$$
$$=(1-x)\left(1+x+x^2\right)$$

22)

$$27-8x^3=3^3-(2x)^3=(3-2x)\left[3^2+3.2x+(2x)^2\right]=$$
$$=(3-x)\left(9+6x+4x^2\right)=(3-x)\left(4x^2+6x+9\right)$$

23)

$$64x^3-27\psi^3=(4x)^3-(3\psi)^3=$$
$$=(4x-3\psi)\left[(4x)^2+4x.3\psi+(3\psi)^2\right]=$$
$$=(4x-3\psi)\left(16x^2+12x\psi+9\psi^2\right)$$

24) $x^3+64=x^3+4^3=(x+4)\left(x^2-4x+4^2\right)=(x+4)\left(x^2-4x+16\right)$

25)

$$8x^3+27=(2x)^3+3^3=(2x+3)\left[(2x)^2-2x.3+3^2\right]=$$
$$=(2x+3)\left(4x^2-6x+9\right)$$

26)

$$8x^3+27\psi^3=(2x)^3+(3\psi)^3=$$
$$=(2x+3\psi)\left[(2x)^2-2x.3\psi+(3\psi)^2\right]=$$
$$=(2x+3\psi)\left(4x^2-6x\psi+9\psi^2\right)$$

27)

$$4x^5-108x^2=4x^2\left(x^3-27\right)=$$
$$=4x^2\left(x^3-3^3\right)=4x^2(x-3)\left(x^2+3x+9\right)$$

28)

$$-56ax^7-7ax^4=-7ax^4\left(8x^3+1\right)=$$

$$=-7ax^4\left[\left(2x\right)^3+1\right]=-7ax^4\left(2x+1\right)\left(4x^2-2x+1\right)$$

29)

$$x^3\left(4x^2-9\right)^3+8\left(4x^2-9\right)=\left(4x^2-9\right)\left(x^3+8\right)=$$

$$=\left[\left(2x\right)^2-3^3\right]\left(x^3+2^3\right)=\left(2x+3\right)\left(2x-3\right)\left(x+2\right)\left(x^2-2x+4\right)$$

30)

$$x^3\left(9x^2+4\right)^3-27\left(9x^2+4\right)=\left(9x^2+4\right)\left(x^3-27\right)=$$

$$=\left(9x^2+4\right)\left(x^3-3^3\right)=\left(9x^2+4\right)\left(x-3\right)\left(x^2+3x+9\right)$$

31)

$$9x^4\psi\left(8x^3-\psi^3\right)-3x^3\psi^2\left(8x^3-\psi^3\right)-15x^2\psi^3\left(\psi^3-8x^3\right)=$$

$$=9x^4\psi\left(8x^3-\psi^3\right)-3x^3\psi^2\left(8x^3-\psi^3\right)+15x^2\psi^3\left(8x^3-\psi^3\right)==$$

$$=\left(8x^3-\psi^3\right)\left(9x^4\psi-3x^3\psi^2+15x^2\psi^3\right)=$$

$$=3x^2\psi\left(8x^3-\psi^3\right)\left(3x^2-x\psi+5\psi^2\right)=$$

$$=3x^2\psi\left[\left(2x\right)^3-\psi^3\right]\left(3x^2-x\psi+5\psi^2\right)=$$

$$=3x^2\psi\left(2x-\psi\right)\left(4x^2+2x\psi+\psi^2\right)\left(3x^2-x\psi+5\psi^2\right)$$

32)

$$9x^5-72x^2-4x^3\psi^2+32\psi^2=9x^2\left(x^3-8\right)-4\psi^2\left(x^3-8\right)=$$

$$=\left(x^3-8\right)\left(9x^2-4\psi^2\right)=\left(x^3-2^3\right)\left[\left(3x\right)^2-\left(2\psi\right)^2\right]=$$

$$=\left(x-2\right)\left(x^2+2x+4\right)\left(3x+2\psi\right)\left(3x-2\psi\right)$$

33) $x^2+8x+16=x^2+2.x.4+4^2=(x+4)^2$

34) $x^2-16x+64=x^2-2.x.8+8^2=(x-8)^2$

35) $9x^2-30x+25=(3x)^2-2.3x.5+5^2=(3x-5)^2$

36) $49x^2+16\psi^2+56x\psi=(7x)^2+2.7x.4\psi+(4\psi)^2=(7x+4\psi)^2$

37)

$$-36x^2-121\psi^2+132x\psi=-(36x^2+121\psi^2-132x\psi)=$$

$$=-\left[(6x)^2-2.6x.11\psi+(11\psi)^2\right]=-(6x-11\psi)^2$$

38) $16x^2-12x+\frac{9}{4}=(4x)^2-2.4x.\frac{3}{2}+\left(\frac{3}{2}\right)^2=\left(4x-\frac{3}{2}\right)^2$

39) $25-15x+\frac{9x^2}{4}=5^2-2.5.\frac{3x}{2}+\left(\frac{3x}{2}\right)^2=\left(5-\frac{3x}{2}\right)^2$

40)

$$-\frac{25x^2}{36}-16\psi^2+\frac{20x\psi}{3}=-\left(\frac{25x^2}{36}-\frac{20x\psi}{3}+16\psi^2\right)=$$

$$=-\left[\left(\frac{5x}{6}\right)^2-2.\frac{5x}{6}.4\psi+(4\psi)^2\right]=-\left(\frac{5x}{6}-4\psi\right)^2$$

41)

$$100x^{10}-180x^5\psi^3\omega^7+81\psi^6\omega^{14}=$$

$$=(10x^5)^2-2.10x^5.9\psi^3\omega^7+(9\psi^3\omega^7)^2=(10x^5-9\psi^3\omega^7)^2$$

42)

$$-16\alpha^8-24\alpha^4\beta^2-9\beta^4=-(16\alpha^8+24\alpha^4\beta^2+9\beta^4)=$$

$$=-\left[(4\alpha^4)^2+2.4\alpha^4.3\beta^2+(3\beta^2)^2\right]=-(4\alpha^4+3\beta^2)^2$$

43) $\frac{25x^8}{16}+\frac{5x^4}{2}+1=\left(\frac{5x^4}{4}\right)^2+2.\frac{5x^4}{4}.1+1^2=\left(\frac{5x^4}{4}+1\right)^2$

44) $x^3+6x^2+12x+8=x^3+3.x^2.2+3x.2^2+2^3=(x+2)^3$

45) $64-48x+12x^2-x^3=4^3-3.4^2.x+3.4x^2-x^3=(4-x)^3$

46) $64-144x+108x^2-27x^3=4^3-3.4^2.3x+3.4(3x)^2-(3x)^3=(4-3x)^3$

47) $x^3+15x^2+75x+125=x^3+3.x^2.5+3x.5^2+5^3=(x+5)^3$

48)

$$8x^9+36x^7+54x^5+27x^3=(2x^3)^3+3.(2x^3)^2.3x+3.2x^3(3x)^2+(3x)^3=$$

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

49)

$$27x^9-108x^{13}+144x^{17}-64x^{21}=(3x^3)^3-3.(3x^3)^2.4x^7+3.3x^3(4x^7)^2-(4x^7)^3=$$

$$=(3x^3-4x^7)^3$$

50) $x^2-2x\psi+\psi^2-a^2=(x-\psi)^2-a^2=(x-\psi+a)(x-\psi-a)$

51)

$$\omega^2-x^2+2x\psi-\psi^2=\omega^2-(x^2-2x\psi+\psi^2)=\omega^2-(x-\psi)^2=$$

$$=[\omega+(x-\psi)][\omega-(x-\psi)]=(\omega+x-\psi)(\omega-x+\psi)$$

52)

$$25x^2-20x\psi+4\psi^2-16\beta^2=(5x)^2-2.5x.2\psi+(2\psi)^2-(4\beta)^2=x^2$$

$$=(5x-2\psi)^2-(4\beta)^2=(5x-2\psi+4\beta)(5x-2\psi-4\beta)$$

53)

$$9\omega^2-4x^2+4x\psi-\psi^2=9\omega^2-(4x^2-4x\psi+\psi^2)=(3\omega)^2-(2x-\psi)^2=$$

$$=[3\omega+(2x-\psi)][3\omega-(2x-\psi)]=(3\omega+2x-\psi)(3\omega-2x+\psi)$$

54)

$$25\psi^2-4x^2-12x-9=25\psi^2-(4x^2+12x+9)=(5\psi)^2-(2x+3)^2=$$

$$=[5\psi+(2x+3)][5\psi-(2x+3)]=(5\psi+2x+3)(5\psi-2x-3)$$

55)

$$9\psi^2-4x^2+\alpha^2-20x-6\alpha\psi-25=9\psi^2-6\alpha\psi+\alpha^2-\left(4x^2+20x+25\right)=$$

$$=\left(3\psi-\alpha\right)^2-\left(2x+5\right)^2=$$

$$=\left[\left(3\psi-\alpha\right)+\left(2x+5\right)\right]\left[\left(3\psi-\alpha\right)-\left(2x+5\right)\right]=\left(3\psi-\alpha+2x+5\right)\left(3\psi-\alpha-2x-5\right)$$

56)

$$4x^2-9\psi^2+\beta^2-\alpha^2-2\left(2\beta x-3\alpha\psi\right)=\left(4x^2-4\beta x+\beta^2\right)-\left(9\psi^2-6\alpha\psi+\alpha^2\right)=$$

$$=\left(2x-\beta\right)^2-\left(3\psi-\alpha\right)^2=$$

$$=\left[\left(2x-\beta\right)+\left(3\psi-\alpha\right)\right]\left[\left(2x-\beta\right)-\left(3\psi-\alpha\right)\right]=\left(2x-\beta+3\psi-\alpha\right)\left(2x-\beta-3\psi+\alpha\right)$$

57)

$$16\alpha^2-9x^4+4\beta^2-\psi^2-16\alpha\beta+6x^2\psi=$$

$$=\left(16\alpha^2-16\alpha\beta+4\beta^2\right)-\left(9x^4-6x^2\psi+\psi^2\right)=$$

$$=\left(4\alpha-2\beta\right)^2-\left(3x^2-\psi\right)^2=$$

$$=\left[\left(4\alpha-2\beta\right)+\left(3x^2-\psi\right)\right]\left[\left(4\alpha-2\beta\right)-\left(3x^2-\psi\right)\right]=$$

$$=\left(4\alpha-2\beta+3x^2-\psi\right)\left(4\alpha-2\beta-3x^2+\psi\right)$$

58) $x^2-5x+6=\left(x-2\right)\left(x-3\right)$

59) $x^2+8x+12=\left(x+2\right)\left(x+6\right)$

60) $x^2+4x-12=\left(x-2\right)\left(x+6\right)$

61) $x^2-7x-18=\left(x+2\right)\left(x-9\right)$

62) $-x^2-3x+4=-\left(x-1\right)\left(x+4\right)$

63) $-x^2+5x-4=-\left(x-1\right)\left(x-4\right)$

64) $-x^2-7x-10=-\left(x^2+7x+10\right)=-\left(x+2\right)\left(x+5\right)$

65) $2x^2-3x-5=\left(x+1\right)\left(2x-5\right)$

66) $3x^2+x-10=\left(x+2\right)\left(3x-5\right)$

67) $3x^2+10x+3=\left(x+3\right)\left(3x+1\right)$

68) $4x^2-9x+5=(x-1)(4x-5)$

69) $-2x^2-x+3=-(2x^2+x-3)=-(x-1)(2x+3)$

70) $-4x^2-5x+21=-(4x^2+5x-21)=-(x+3)(4x-7)$

71) $6x^2-5x+1=(2x-1)(3x-1)$

72) $9x^2+21x+10=(3x+2)(3x+5)$

73) $6x^2+7x-3=(2x+3)(3x-1)$

74) $8x^2-6x-9=(2x-3)(4x+3)$

75) $12x^2+13x-4=(3x+4)(4x-1)$

76) $6x^2+23x+20=(3x+4)(2x+5)$

77) $-6x^2-x+12=-(6x^2+x-12)=-(3x-4)(2x+3)$

78) $-10x^2+23x-12=-(10x^2-23x+12)=-(2x-3)(5x-4)$

79) $-12x^2-x+6=-(12x^2+x-6)=-(3x-2)(4x+3)$

80) $-15x^2+26x-8=-(15x^2-26x+8)=-(3x-4)(5x-2)$

81) $-24x^5+28x^4+12x^3=-4x^3(6x^2-7x-3)=-4x^3(3x+1)(2x-3)$

82) $-60x^7-5x^6+30x^5=-5x^5(12x^2+x-6)=-5x^5(3x-2)(4x+3)$

83) $2x^6-6x^5-20x^4=2x^4(x^2-3x-10)=2x^4(x+2)(x-5)$

84)

$$(3x-1)^2-2x(2x-5)-10=$$
$$=9x^2-6x+1-4x^2+10x-10=$$
$$=5x^2+4x-9=(x-1)(5x+9)$$

85)

$$(2x-3)^2-3(x+2)(x-2)+8x-33=$$

$$=4x^2-12x+9-3(x^2-4)+8x-33=$$

$$=4x^2-12x+9-3x^2+12+8x-33=$$

$$=x^2-4x-12=(x-6)(x+2)$$

86) $(3x-4)^2-2(3x-4)-8=\ldots=(3x-2)(3x-8)$

87) $(4x+5)^2+7(4x+5)+12=4(x+2)(4x+9)$

88)

$$x^4-26x^2+25=(x^2)^2-2.x^2.5+25-16x^2=$$

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

$$=(x+1)(x-5)(x-1)(x+5)$$

89)

$$x^4+5x^2+49=(x^2)^2+2.x^2.7+49-9x^2=$$

$$=(x^2+7)^2-(3x)^2=(x^2-3x+7)(x^2+3x+7)$$

90)

$$4x^4-13x^2+9=(2x^2)^2-2.2x^2.3+3^2-x^2=$$

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

$$=(x-1)(2x+3)(x+1)(2x-3)$$

91)

$$9x^4-25x^2+16=(3x^2)^2+2.3x^2.4+4^2-49x^2=$$

$$=(3x^2+4)^2-(7x)^2=(3x^2+7x+4)(3x^2-7x+4)=$$

$$=(x+1)(3x+4)(x-1)(3x-4)$$

92)

$$-25x^4-71x^2-64=-\left(25x^4+71x^2+64\right)=$$

$$=-\left[\left(5x^2\right)^2+2.5x^2.8+8^2-9x^2\right]=-\left[\left(5x^2+8\right)^2-\left(3x\right)^2\right]=$$

$$=-\left(5x^2+3x+8\right)\left(5x^2-3x+8\right)$$

93)

$$-12x^5\psi^2+87x^3\psi^4-75x\psi^6=-3x\psi^2\left(4x^4-29x^2\psi^2+25\psi^4\right)=$$

$$=-3x\psi^2\left[\left(2x^2\right)^2-2.2x^2.5\psi^2+\left(5\psi^2\right)^2-9x^2\psi^2\right]=$$

$$=-3x\psi^2\left[\left(2x^2-5\psi^2\right)^2-\left(3x\psi\right)^2\right]=$$

$$=-3x\psi^2\left(2x^2+3x\psi-5\psi^2\right)\left(5x^2-3x\psi-5\psi^2\right)=$$

$$=-3x\psi^2\left(x-\psi\right)\left(2x+5\psi\right)\left(x+\psi\right)\left(2x-5\psi\right)$$

94)

$$\left(3x^3-12x\right)\left(18x-2x^4\right)\left(x^4-5x^2+4\right)=$$

$$=3x\left(x^2-4\right)\left[-2x\left(x^3-8\right)\right]\left(x^2-4\right)\left(x^2-1\right)=$$

$$=-6x^2\left(x+2\right)\left(x-2\right)\left(x-2\right)\left(x^2+2x+4\right)\left(x+2\right)\left(x-2\right)\left(x+1\right)\left(x-1\right)=$$

$$=-6x^2\left(x+2\right)^2\left(x-2\right)^3\left(x^2+2x+4\right)\left(x+1\right)\left(x-1\right)$$

95)

$$\left(4x-4x^4\right)\left(4x^2-4x-3\right)=$$

$$=-4x\left(x^3-1\right)\left(2x-3\right)\left(2x+1\right)=$$

$$=-4x\left(x-1\right)\left(x^2+x+1\right)\left(2x-3\right)\left(2x+1\right)$$

96) $x^4+3x^3-4x-12=\left(x-2\right)\left(x+2\right)\left(x+3\right)$

97) $2x^3-x^2-12x-9=\left(x+1\right)\left(x-3\right)\left(2x+3\right)$

98) $6x^3-5x^2-29x+10=\left(x+2\right)\left(2x-5\right)\left(3x-1\right)$

99) $x^3-12x+16=(x-2)^2(x+4)$

100) $x^4-11x^2-18x-8=(x+1)^2(x+2)(x-4)$

101) $x^4+3x^3-12x^2-20x+48=(x-2)^2(x+3)(x+4)$

102)

$$2x^5+5x^4-27x^3-28x^2+116x-48=$$
$$=(x-2)^2(x+3)(x+4)(2x-1)$$

103)

$$3x^5+x^4-33x^3-65x^2-42x-8=$$
$$=(x+1)^2(x-2)(x-4)(3x+1)$$

104)

$$x^6-20x^4-18x^3+91x^2+162x+72=$$
$$=(x+1)^2(x-2)(x-3)(x+3)(x-4)$$

105) $-2x^6-6x^5+24x^4+40x^3-96x^2=-2x^2(x-2)^2(x+3)(x+4)$

106)

$$-6x^8-15x^7+81x^6+84x^5-348x^4+144x^3=$$
$$=-3x^3(x-2)^2(x+3)(x+4)(2x-1)$$

107)

$$-15x^9-5x^8+165x^7+325x^6+210x^5+40x^4=$$
$$=-5x^4(x+1)^2(x-2)(x-4)(3x+1)$$

108)

$$-2x^7+40x^5+36x^4-182x^3-324x^2-144x=$$
$$=-2x(x+1)^2(x-2)(x-3)(x+3)(x-4)$$

109)

$$-4x^7+28x^6-144x^4=-4x^4(x^3-7x^2+36)=$$
$$=-4x^4(x+2)(x-3)(x-6)$$

110)

$$-5x^6+60x^4+80x^3=-5x^3\left(x^3-12x-16\right)=$$

$$=-5x^3\left(x+2\right)^2\left(x-4\right)$$

111)

$$-2x^6-6x^5+2x^4+22x^3+24x^2+8x=$$

$$=-2x\left(x^5+3x^4-x^3-11x^2-12x-4\right)=$$

$$=-2x\left(x+1\right)^3\left(x-2\right)\left(x+2\right)$$