Unit 987 1,2.3.4 towers etc.

$a^b = a\wedge b$

987.1

4∧(3∧2)+1 = 262145 = $2^{18}+1$

$= a_0*a_1*a_2*a_3$

$a_0 = (3^0*4+1) =$ 5prime

$a_1 = (3^1*4+1) =$ 13p $= 3*a_0 - 2$

$a_2 = (3^2*4+1) =$ **4*(3∧2)+1 =** 37p $= 3*a_1 - 2$

$a_3 = (3^3*4+1) =$ 109p $= 3*a_2 - 2$

$a_i = (3^i*4+1)$; $a_{i+1} = 3*a_i - 2$

Lateral **1**

a_0a_1=1*64+1, a_2a_3=63*64+1

$$\begin{vmatrix} a_0 & a_1 \\ a_2 & a_3 \end{vmatrix} = \begin{vmatrix} 5 & 13 \\ 37 & 109 \end{vmatrix} = 64$$

Lateral **2**

How about a_i ; i=4(1)… ?

a_4=81*4+1=325=5^2*13=3*a_3-2

a_5=243*4+1=973=7*(139p)= 3*a_4-2

=3*(3*(3*(3*(3a_0-2)-2)-2)-2)-2

a_6=739*4+1=2917p=3*a_5-2

a_7=2187*4+1= 8749=13*(673p)=3*a_6-2

a_8=6561*4+1=26245=5*29*(181p)= 3*a_7-2

$$\begin{vmatrix} a_i & a_{i+1} \\ 1 & 3 \end{vmatrix} = 2, \quad \begin{vmatrix} a_i & a_{i+1} \\ a_{i+2} & a_{i+3} \end{vmatrix} = 2^6 * 3^i$$

Find more a_i primes. →

$a_0 = 5$

$a_{1=0+1} = 13 = 3*(a_0)-2$

$a_{2=1+1} = 37 = 3*(a_1)-2$

$a_{3=2+1} = 109 = 3*(a_2)-2 = 3*(3*(3*(a_0)-2)-2)-2$

$a_{6=3+3} = 2917 = 3*(3*(3*(a_3)-2)-2)-2 =$

$3*(3*(3*(3*(3*(3*(a_0)-2)-2)-2)-2)-2)-2$

$a_{14=6+8} = 19\ 131\ 877 =$

$3*(3*(3*(3*(3*(3*(3*(3*(a_6)-2)-2)-2)-2)-2)-2)-2)-2$

$a_{15=14+1} = 57\ 395\ 629 = 3*(a_{14})-2$

……

$a_{39} = a_{15+24} = 16\ 210\ 220\ 612\ 075\ 905\ 069 =$

$3*(3*(3*(3*(3*(3*(3*(3*(3*(3*(3*(3*(3*(3*(3*(3*(3*(3*(3*(3*(3*(a_{15})-2)-2)-2)-2)-2)-2)-2)-2)-2)-2)$

$-2)-2)-2)-2)-2)-2)-2)-2)-2)-2)-2)-2)-2)-2)-2)-2)-2)-2)-2)-2)-2$

$a_{201} =$

3 187 367 866 510 497 232 065 375 864 429 355 521 950 801 431 840 733 951 694 899 540 869 109 890 815 626 195 932 616 388 528 013

$a_{249} =$

254 244 997 489 062 154 119 688 681 828 370 010 268 347 235 132 197 783 249 391 539 881 181 660 045 297 550 875 174 703 528 321 187 968 562 717 038 040 968 333

$a_{885} =$

715 105 993 881 356 609 575 487 813 556 642 185 594 391 286 848 144 349 445 247 173 957 071 294 019 723 127 806 585 360 664 291 683 091 853 410 512 913 359 481 528 831 779 030 509 224 699 930 273 187 370 074 946 562 809 417 181 888 350 866 387 236 633 347 907 110 947 946 251 653 883 372 655 272 820 377 982 805 378 880 593 061 601 783 935 466 826 716 658 110 149 080 224 518 820 998 622 417

006 158 398 692 771 563 474 999 822 564 454 473 460 584 807 458 376 915 278 378 753 473 478 405 154 837 756 817 246 299 078 092 165 340 741 397 056 594 768 154 627 540 173

……

Discuss the connection of the a_1 with the Mersenne primes [1,2,3]

[1] https://oeis.org/A000668
[2] http://mathworld.wolfram.com/MersennePrime.html
[3] https://en.wikipedia.org/wiki/Mersenne_prime

Embedding of the a_i-generated primes into the prime sequence:

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97, 101, 103, 107, 109, 113, 127, 131, 137, 139, 149, 151, 157, 163, 167, 173, 179, 181, 191, 193, 197, 199, … continue

red – a_i blue - Mersenne

Lateral **3**

How about a_i ; i=0(-1)… ?

Lateral **4**

cadenza ad libitum

4.1

$a_0 = 7$, $a_{i+1} = 3a_i - 2^{i+1}$; i=0,1,2,3,…

$$\begin{vmatrix} a_i & a_{i+1} \\ 1 & 3 \end{vmatrix} = 2^{i+1}$$

$$\begin{vmatrix} a_i & a_{i+1} \\ a_{i+2} & a_{i+3} \end{vmatrix} = 2^{i+1} * 3^i * 5^2$$

$a_0 = 7p$

$a_1 = 19p$

a_2=53p
a_3=151p
a_4=437=19*23
a_5=1279p
a_6=3773=7^3*11
a_7=11191=19^2*31
a_8=33317p=
3*(3*(3*(3*(3*(3*(3*(3*(3*(a_0)-2)-4)-8)-16)-32)-64)-128)-256
a_9=99439p=
3*(3*(3*(3*(3*(3*(3*(3*(3*(3*(a_0)-2)-4)-8)-16)-32)-64)-128)
-256)-512
Continue!
Use f.i. https://de.numberworld.info/faktorisierungsRechner
https://de.numberworld.info/primCheck

4.2

Representation of a natural number N by a nested expression
N = f(n) = a_n*(…*(a_3*(a_2*(a_1*(s)+b_1)+b_2)+b_3)+…)+b_n;

s, a_i, $b_i \in \mathbb{Z}$

f(i+1)=a_{i+1}*f(i)+b_{i+1}; i=0,1,2,…
f(0)=s

Example 1
s=1, a_i=3, b_i=i^2
f(7)=3*(3*(3*(3*(3*(3*(3*(1)+1)+4)+9)+16)+25)+36)+49
=5431p

Example 2
s=1, a_i=i, b_i=(2i-1) → nonprime generator?
Find an algorithm for N→f(n).

Example 3
Finite prime tree
s=7, a_i=3, b_i=±2

$$7p \begin{cases} \rightarrow (+)23p \begin{cases} \rightarrow (+)71p \rightarrow (-)211p \rightarrow (-)631pex \\ \rightarrow (-)67p \rightarrow (-)199p \rightarrow (+)599pex \end{cases} \\ \rightarrow (-)19p \rightarrow (+)59p \rightarrow (+)p179ex \end{cases}$$

Find longer prime trees.

987.2

1+ 2*(3^4) = 163p = 41p*4 – 1

Lateral **1**

$f(x) = x^2 + 4x + 41p = (x+2)^2 + 37p$ (see [1,2])

→ f(-x) = f(x-4)

f(-10) = 101p == f(6)

f(-9) = 86 = 2*43p = f(5)

f(-8) = 73p = f(4)

f(-7) = 62 =2*31p = f(3)

f(-6) = 53p = f(2)

f(-5) = 46 = 2*23p = f(1)

f(-4) = 41p = f(0)

f(-3) = 38 = 2***19p** = f(-1)

f(-2) = **37p** MIN

f(-1) = 38 = 2***19p**

f(0) = 41p

f(1) = 46 =2*23p

f(2) = 53p

f(3) = 62 =2*31p

f(4) = 73p

f(5) = 86 = 2*43p

f(6) = 101p

f(7) = 118 = 2*59p

f(8) = 137p

f(9) = 158 = 2*78p
f(10) = 181p
f(11) = 206 = 2*103p
f(12) = 233p
f(13) = 262 =2*131p
f(14) = 293p
f(15) = 326 = 2*163p
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
f(**16**) = 361 = (19p)*(19p) semiprime [3]
f(17) = 398 = 2*199p
f(18) = 437 = (19p)*(23p)
f(19) = 478 = 2*239p
f(20) = 521p
f(21) = 566 = 2*283p
f(22) = 613p
f(23) = 662 = 2*331p
f(24) = 713 = (23p)*(31p)
f(25) = 766 = 2*383p
f(26) = 821p
f(27) = 878 = 2*439p
f(28) = 937p
f(29) = 998 = 2*499p
f(30) = 1061p
f(31) = 1126 = 2*563p
f(32) = 1193p
f(33) = 1262 = 2*631p

f(34) = 1333 = (31p*43p)
f(35) = 1406 =2*(19p)*(37p)
f(36) = 1481p
f(37) = 1558 = 2*(19p)*(41p)
f(38) = 1637p
f(39) = 1718 = 2*859p
f(40) = 1801p
f(41) = 1886 = 2*(23p)*(41p)
f(42) = 1973p
f(43) = 2062 = 2*1031p
f(44) = 2153p
f(45) = 2246 = 2*1123p
f(46) = 2341p
f(47) = 2438 = 2*(23p)*(53p)
f(48) = 2537 = (43p)*(59p)
f(49) = 2638 = 2*1319p
f(50) = 2741p
f(51) = 2846 = 2*1423p
f(52) = 2953p
f(53) = 3062 = 2*1531p
f(54) = 3173 = (19p)*(167p)
f(55) = 3286 = 2*(31p)*(53p)
f(56) = 3401 = (19p)*(179p)
f(57) = 3518 = 2*1759p
f(58) = 3637p

f(59) = 3758 = 2*1879p
f(60) = 3881p
f(61) = 4006= 2*2003p
f(62) = 4133p
f(63) = 4262 = 2*2131p
f(64) = 4393 = (23p)*(191p)
f(65) = 4526 = 2*(31p)*(73p)
f(66) = 4661 = (59p)*(79p)
f(67) = 4798 = 2*2399p
f(68) = 4937p
f(69) = 5078 = 2*2539p
f(70) = 5221 = (23p)*(227p)
f(71) = 5366 = 2*2683p
f(72) = 5513 = (37p)*(149p)
f(73) = 5662 = 2*(19p)*(149p)
f(74) = 5813p
f(75) = 5966 = 2*(19p)*(157p)
f(76) = 6121p
f(77) = 6278 = 2*(43p)*(73p)
f(78) = 6437 = (41p)*(157p)
f(79) = 6598 = 2*3299p
f(80) = 6761p
f(81) = 6926 = 2*3463p
f(82) = 7093 = (41p)*(173p)
f(83) = 7262 = 2*3631p

f(84) = 7433p
f(85) = 7606 = 2*3803p
f(86) = 7781 = (31p)*(251p)
f(87) = 7958 =2*(23p)*(173p)
f(88) = 8137 = (79p)*(103)
f(89) = 8318 = 2*4159p
f(90) = 8501p
f(91) = 8686 = 2*(43p)*(101p)
f(92) = 8873 =(19p)*(467p)
f(93) = 9062 = 2*(23p)*(197p)
f(94) = 9253 = (19p)*(487p)
f(95) = 9446 = 2*4723p
f(96) = 9641 = (31p)*(311p)
f(97) = 9838 = 2*4919p
f(98) = 10037p
f(99) = 10238 = 2*5119p
f(100) = 10441 = (53p)*(197p)
Continue↕
f(101)=10646=2*5323p
f(102)=10853p
f(103)=11062=2*5531p
f(104)=11273p
f(105)=11486=2*5743p
f(106)=11701p
f(107)=11918=2*(59p)*(101p)
f(108)=12137=(53p)*(229p)
f(109)=12358=2*(37p)*(167p)

f(110)=12581=(23p)*547p)
f(111)=12806=2*(19p)*(337p)
f(112)=13033p
f(113)=13262=2*(19p)*(349p)
f(114)=13493=(103p)*(131p)
f(115)=13726=2*6863p
f(116)=13961=(23p)*(607p)
f(117)=14198=2*(31p)*(229p)
f(118)=14437p
f(119)=14678=2*(41p)*(179p)
f(120)=14921=(43p)*(347p)
f(121)=15166=2*7583p
f(122)=15413p
f(123)=15662=2*(41p)*(191p)
f(124)=15913p
f(125)=16166=2*(59p)=(137p)
f(126)=16421p
f(127)=16678=2*(31p)*(269p)
f(128)=16937p
f(129)=17198=2*8599p
f(130)=17461=(19p)*(919p)
f(131)=17726=2*8863p
f(132)=17993=(19p)*(947p)
f(133)=18262=2*(23p)*(397p)
f(134)=18 533=(43p)*(431p)
f(135)=18806=2*9403p
f(136)=19081p
f(137)=19358=2*9679p
f(138)=19637=(73p)*(269p)
f(139)=19918=2*(23p)*(433p)
f(140)=20201p

f(141)=20486=2*10243p
f(142)=20773p
f(143)=21062=2*10531
f(144)=21353=(131p)*(163p)
f(145)=21646=2*(79p)*(137p)
f(146)=21941=(37p)*(593p)
f(147)=22238=2*11119p
f(148)=22537=(31p)*(727p)
f(149)=22838=2*(19p)*(601p)
f(150)=23141=(73p)*(317p)
f(151)=23446=2*(19p)*(617p)
f(152)=23753p
f(153)=24062=2*(53p)*(227p)
f(154)=24373p
f(155)=24686=2*12343p
f(156)=25001=(23p)*(1087p)
f(157)=25318=2*12659p
f(158)=25637=(31p)*(827p)
f(159)=25958=2*12979p
f(160)=26281=(41p)*(641p)
f(161)=26606=2*(53p)*(251p)
f(162)=26933=(23p)*(1171p)
f(163)=27262=2*(43p)*(317p)
f(164)=27593=(41p)*(673p)
f(165)=27926=2*13963p
f(166)=28261*(59p)*(479p)
f(167)=28598=2*(79p)*(181p)
f(168)=28937=(19p)*(1523p)
f(169)=29278=2*14639p
f(170)=29621(19p)*(1559p)
f(171)=29966=2*14983p

f(172)=30313p
f(173)=30662=2*15331p
f(174)=31013p
f(175)=31366=2*15683p
f(176)=31721p
f(177)=32078=2*(43p)*(373p)
f(178)=32437=(163p)*(199p)
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
f(**179**)=32798=2*(23p)*(23p)*(31p) 3-almost-prime [3]
f(180)=33161p
f(181)=33526=2*16763p
f(182)=33893p
f(183)=34262=2*(37p)*(463p)
f(184)=34633=(59p)*(587p)
f(185)=35006=2*(23p)*(761p)
f(186)=35381p
f(187)=35758=2*(19p)*(941p)
f(188)=36137p
f(189)=36518=2*(19p)*(31p)*(31p)
f(190)=36901p
f(191)=37286=2*(103p)*(181p)
f(192)=37673=(101p)*(373p)
f(193)=38062=2*19031p
f(194)=38453p
f(195)=38846=2*19423p
f(196=39241p
f(197)=39638=2*19819p
f(198)=40037p
f(199)=40438=2*20219p
f(200)=40841p
f(201)=41246=2*(41p)*(503p)

f(202)=41653=(23p)*(1811p)
f(203)=42062=2*21031p
f(204)=42473p
f(205)=42886=2*(41p)*(523p)
f(206)=43301=(19p)*(43p)*(53p)
f(207)=43718)=2*21859p
f(208)=44137=(19p)*(23p)*(101p)
f(209)=44558=2*22279p
f(210)=44981=(31p)*(1451p)
f(211)=45406=2*(73p)*(311p),
f(212)=45833p
f(213)=46262=2*23131p
f(215)=47126=2*23563p
pppppppppppppppppppppppppppppppppppppppppppppprimesonly
f(218)=48437p
f(219)=48878=2*24439p
f(226)=52021p
f(228)=52937p
f(229)=53398=2*26699p
f(230)=53861p
f(233)=55262=2*27631p
f(234)=55733p
f(236)=56681p
f(237)=57158=2*28579p
f(238)=57637p
f(239)=58118=2*29059p
f(240)=58601p
f(247)=62038=2*31019p
f(250)=63541p
f(252)=64553p
f(253)=65062=2*32531p

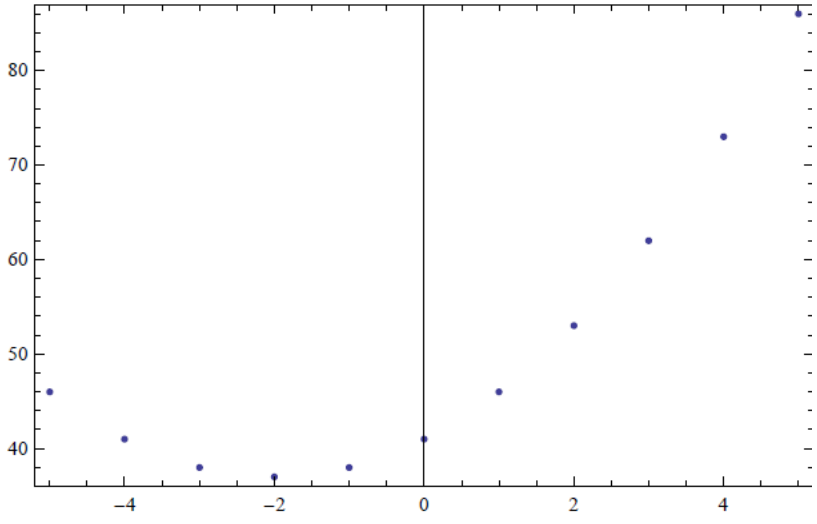
f(256)=66601p
f(261)=69206=2*34603p
f(264)=70793p
f(266)=71861p
f(268)=71937p
f(269)=73478=2*36739p
f(270)=74021p
f(273)=75662=2*37831p
f(274)=76213p
f(278)=78437p
f(279)=78998=2*39499p
f(280)=79561p
f(281)=80126=2*40063p
f(285)=82406=2*41203p
f(286)=82981p
f(288)=84137p
f(289)=84718=2*42359p
f(291)=85886=2*42943p
f(295)=88246=2*44123p
f(299)=90638=2*45319p
f(305)=94286=2*47143p
f(308)=96137p
f(310)=97381p
f(311)=98006=2*49003p
f(315)=100526=2*50263p
f(316)=101161p
f(318)=102437p
f(319)=103078=2*51539p
f(321)=104366=2*52183p
f(326)=107621p
f(327)=108278=2*54139p

f(329)=109598=2*54799p
f(330)=110261p
f(332)=111593p
f(333)=112262=2*56131p
f(336)=114281p
f(338)=115637p
f(342)=118373p
f(345)=120446=2*60223p
f(347)=121838=2*60919p
f(350)=123941p
f(351)=124646=2*62323p
f(352)=125353p
f(353)=126062=2*63031p
f(355)=127486=2*63743p
f(356)=128201p
f(359)=130358=2*65179p
f(362)=132533p
f(364)=133993p
f(365)=134726=2*(31p)*(41p)*(53p)
f(366)=135461p
f(367)=136198=2*68099p
f(369)=137678=2*(23p)*(41p)*(73p)
f(374)=141413p
f(381)=146726=2*73363p
f(383)=148262=2*74131p
f(384)=149033p
f(385)=149806=2*74903p
3333333333333333333333333333333333333333-almost-primesonly
f(392)=155273=(23p)*(43p)*(157p)
f(396)=158441=(19p)*(31p)*(269p)
f(406)=166501=(31p)*(41p)*(131p)

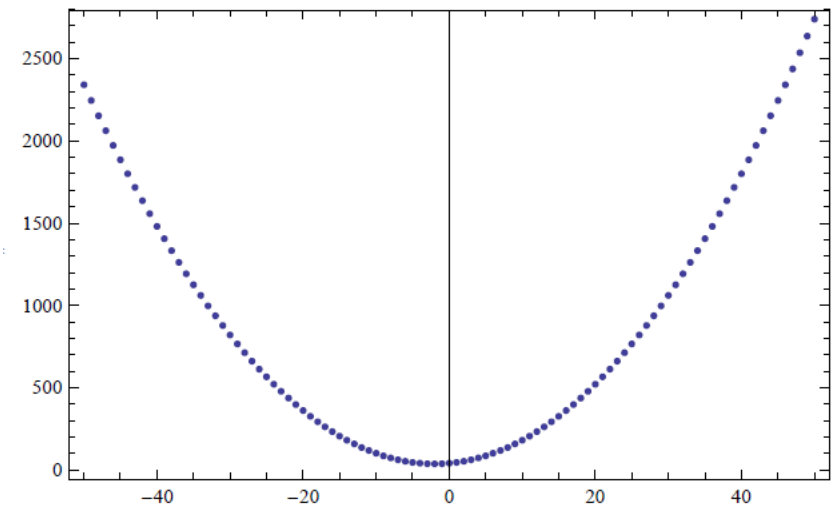
f(415)=173926=2*(19p)*(23p)*(199p)
f(442)=197173=(37p)*(73p)*(73p)
f(455)=208886=2*(19p)*(23p)*(239p)
f(461)=214406=2*(23p)*(59p)*(79p)
f(478)=230437=(23p)*(43p)*(233p)
f(479)=231398=2*(37p)*(53p)*(59p)
Continue!

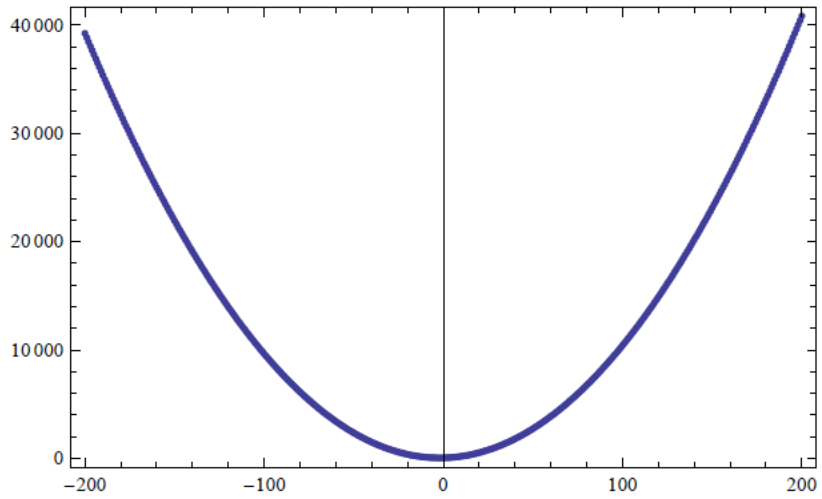
Graph of f(x)

f(x)



x





x≤178 f(even) = prime or semiprime [3],
f(odd) = 2*(prime or semiprime),
→ frequency analysis of the primes (within f(x) and within the prime sequence),
→ frequency analysis of the semiprimes

x>178 frequency analysis of the primes, semiprimes and k-almost-primes [3]

[1]
Weisstein, Eric W. "Prime-Generating Polynomial." From *MathWorld*--A Wolfram Web Resource.
http://mathworld.wolfram.com/Prime-GeneratingPolynomial.html
[2]
https://en.wikipedia.org/wiki/Formula_for_primes#Prime_formulas_and_polynomial_functions
[3] https://en.wikipedia.org/wiki/Almost_prime

Lateral 2

Embedding of the ($f(x)=x^2+4x+41$)-generated primes into the prime sequence +

* frequency analysis
* 2D representation (see [4,5])

[4] E.P. Stoschek, D.Schönfeld. Computergraphik im Spannungsfeld

zwischen Algorithmus und Phantasie. Signa in silico. Chapter 1
ISBN 3-8171-1640-3
[5] https://en.wikipedia.org/wiki/Labyrinth
For discussion: Algorithmically generated labyrinths as tool for analysis of number seqences.

Lateral **3** 41 and 163

$41*4 - 1 = 163$

$41 + 163 = \sum_{i=1}^{8} i^2$

Lateral **4** 41 and ……

$41 = 4^2 + 5^2$

$41 = (-1)^3 + (-80538738812075974)^3$
$+ 80435758145817515^3$
$+ 12602123297335631^3$

https://www.tagesspiegel.de/wissen/die-antwort-auf-alles-das-matheproblem-um-die-zahl-42-ist-geknackt/25021142.html?utm_source=pocket-newtab

Lateral **5** 163 and ……

** Deb 9, p. 2-6
** Unit 15, part 27, p. 3-4
** Unit 15, part 28, p. 3-6
** Unit 15, part 29, p. 3-4
** Unit 83.1.2

12.10.2019 EPSalg DScalc