LESSON PLAN

 Course: Grade 12 U Advanced Functions
 Lesson: <u>3 - 2</u>

 Unit/Chapter: <u>Exponents & Logarithms</u> Topic: <u>Exponential Equations</u>

\square homework check: <u>FM11</u> exercise 1.8 and 1.9 p. 17 – 19

note: <u>Exponential Equations</u>

Recall, in order to solve an exponential equation, we must have the bases equal. To achieve equal bases, we require a good understanding of our basic exponent rules. Once the bases are equal, we can then set the exponents equal and solve for x using regular equation solving processes.

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examples)

$$4^{2x-1} = \frac{1}{16^{3x+2}}$$

$$4^{2x-1} = (16^{3x+2})^{-1}$$

$$4 \cdot 3^{2x+3} = 108$$

$$4^{2x-1} = [(4^2)^{3x+2}]^{-1}$$

$$4^{2x-1} = 4^{-6x-4}$$

$$3^{2x+3} = 27$$

$$3^{2x+3} = 3^3$$

$$\therefore 2x + 3 = 3$$

$$8x = -3$$

$$8x = -3$$

$$2x = 0$$

$$x = 0$$

$$3^{2x} - 6(3^{x}) - 27 = 0$$

$$2^{x+3} - 2^{x} = 224$$

$$2^{x}(2^{3} - 1) = 224$$

$$2^{x}(7) = 224$$

$$2^{x} = 32$$

$$2^{x} = 2^{5}$$

$$\therefore x = 5$$

$$3^{2x} - 6(3^{x}) - 27 = 0$$

let $a = 3^{x}$

$$a^{2} - 6a - 27 - 0$$

$$(a - 9)(a + 3) = 0$$

$$a = 9 \text{ and } a = -3$$

but $a = 3^{x}$

$$3^{x} = 9 \text{ and } 3^{x} = -3$$

$$x = 2$$

extraneous

□ homework assignment: <u>FM11</u> exercise 1.12 p. 25 #3, 4 and

<u>AW11</u> exercise 1.6 p. 51 #12

Equations such as $2^{2x-1} = 2^9$ are solved by setting the exponents equal to each other and solving the equation.

2x - 1 = 92x = 10x = 5 This method of solving an exponential equation is based on the property that if $a^x = a^y$, then x = y, for $x \neq -1, 0, 1$. The bases must **EXAMPLE 2.** Solve. $4^{8x} = \frac{1}{16}$ be the same. EXAMPLE 1. Solve. 3^x = 81 SOLUTION: SOLUTION: $4^{8x} = \frac{1}{16}$ 3× = 81 $3^{x} = 3^{4}$ x = 4 $(2^2)^{8x} = 2^{-4}$ $2^{16x} = 2^{-4}$ \therefore the solution is x = 4. 16x = -4-4 х = 16 Check **EXAMPLE 3.** Solve. $5^{x-2} = 625$ x = -4 these solutions. : the solution is $x = -\frac{1}{4}$ SOLUTION: $5^{x-2} = 625$ $5^{x-2} = 5^4$ x - 2 = 4x = 6 .. the solution is 6. EXERCISE 1.12 (d) $(-1)^{\times} = 1$ (a) 54 - x - 1

в	1. Solve the following equations for $x \in N$. (a) $2^{x} = 32$ (b) $3^{x} = 27$ (c) $2^{x} = 64$ (d) $5^{x} = 25$ (c) $2^{x} = 91$ (f) $7^{x} = 49$	(c) $5^{4-x} = \frac{2}{5}$ (e) $3^{2-x} = 1$ (g) $4^{x-1} = 1$ (i) $7^{x-2} = 49$	(f) $4^{3x} = 64$ (h) $(-1)^{2x} = 1$ (j) $2^{-2x} = 32$	
	(a) $(-2)^{x} = -27$ (b) $(-2)^{x} = -27$ (c) $(-2)^{x} = 16$ (c) $(-2)^{x} = -8$ (c) $(-5)^{x} = 25$	4. Solve the following (a) $4^{\times} = 8$	for $x \in R$. (b) $2^{9x} = \frac{1}{8}$	
ι λ	2. Solve the following equations for $x \in N$. (a) $4^{x} = 256$ (b) $6^{x+3} = 6^{2x}$ (c) $9^{x} = 729$ (d) $2^{x} = 16^{4}$ (e) $2^{x} = 4^{x-1}$ (f) $2(5^{x}) = 1250$ (g) $9^{2x-6} = 3^{x+6}$ (h) $4^{2x-1} = 64$ (i) $1^{x} = 1$ (j) $(-1)^{x} = 1$ 3. Solve the following equations for $x \in I$. (a) $6^{3x-6} = 1$ (b) $2^{-x} = 128$	(a) $4^{-1} = 2^{-1}$ (c) $64^{x} = 16$ (e) $9^{2x+1} = 27$ (g) $32^{3x-2} = 64$ (i) $10^{x} = 10\ 000$ (k) $3(5^{x+1}) = 15$ (m) $5(4^{x}) = 10$	(d) $9^{6x} = \frac{1}{27}$ (f) $5^{2x+1} = \frac{1}{125}$ (h) $3^{3x-1} = \frac{1}{81}$ (j) $10^{x-2} = \frac{1}{10\ 000}$ (l) $2(3^{x-2}) = 18$ (n) $3^{2x-1} + 1 = 2$	
	(a) 0 · · · · · · · · · · · · · · · · · ·		REAL NUMBERS	2

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$(g) \frac{1}{10,000}$	(h) 1/1837	` ′ 0		х А	~~~ ·	
2. (a) $\frac{1}{1}$	(b) $\frac{x^2}{x^2}$	$(c) = \frac{1}{2}$	_	$(d) \frac{1}{2}$		(x) $(y)^{3}$
3. (a) x ⁻³	(b) 2ab-4	(c) πx	0 ⁴ 2∨	(u) a²	(e) a ¹⁰	$(1) \left(\frac{1}{x}\right)$
4. (a) ⁸ / ₂₅	(b) 1024	(c) 꽃	. y	(d) 4	(e) 9	(f) 2
(g) ⁵ / ₄	(h) <u>10</u>	(i) 2		(j) 625	(k) 45	(1) Z
5. (a) 343x⁶ y ⁹	(b) <u>a⁵b¹⁰</u> 243	•	(c) <u>64a</u> 3 b ⁶ d1	C ⁹	(d) $\frac{a^2}{b^3}$	(e) a ² b ² x ² y ⁴
$(f) \frac{a^4}{b^2} - 2\frac{a^2}{b} + 1$	(g) a ⁶ + a ⁵	- 5a²	(h) 2x ² ·	$-\frac{1}{x^2}-1$	(i) $\frac{1}{b^{2n}}$	$(j) \frac{1}{x^{2n}} - \frac{1}{x^{2m}}$
EXERCISE 1.10	1.000000110-1					A y
1. (a) \$9658.92	(b) \$18 655.	38	(c) \$787	5.66	(d) \$3655.96	(e) \$3867.65
(†) \$457.17 2. \$5499.49	(g) \$6143.17 3. \$4319 78	,	1 \$5121	59	(-) +	(0) \$0007.05
EXERCISE 1 11			4. 00101.	.50		
$1.(a)\sqrt[3]{2}$	$(h) \sqrt{27}$		(-) -3/		(I) 3(T	_
$(4) \sqrt{2}$	(b) \sqrt{37}		(c) √x		(d) ∜4 1	(e) $\sqrt{8} = 2\sqrt{2}$
(1) \27	(g) √a² or (∖	⁄a)²	(h) ∜x⁴o	or (√⁄x)⁴	(i) $\frac{1}{\sqrt{2}}$	(j) √ 7
(K) \[\[\]{a^3}	() 1/81	:				•
2. (a) $3^{\frac{1}{2}}$	(b) 19 ²	(c) 23 ⁷		(d) $x_{\frac{1}{2}}^{\frac{1}{2}}$	(e) 7 ²	(f) 7 ²
(g) 6° 3 (a) 5	(h) 13 ³	(i) a⁵		(j)a ^š	(k) 5 ^{-1/2}	() 7 ⁻³ /4
(a) = (a)	(D) 4 (F) 1	(c) 27		(d) 1	· (e) 1	(f) 21.2561
(y) = 3	(n) ¹ 2	(i) 4		(j)]	(k) −2	(1)4
(a) 10	(D) 128	(C) 100		(d) 1	(e) 27	$(f) \frac{1}{125}$
(m) ²	(n) 3 (n) 12	(1) 36		(j) 343	(k) 2	(1) 162
(s) 8	$(1) \frac{7}{7}$	$(0) \frac{1}{512}$		(p) 96 (m) 5	(q) 0.08	(r) 3
5. (a) 2 ⁵	(t) 3 ⁸	(u) /	$(a) x^{2} x^{\frac{1}{2}}$	(V) <u>ĕ</u>	(w) 3	$(x) \frac{5}{108}$
2	(5) 5		(C) X-y-		(0) a³b⁴ 40 √E x3 x ⁸	(e) ab ² c ³
- (f) x + 3x ³	(g) 2x²y ^½		$(h) \frac{16x^{\circ}}{v^{2}}$		(i) $\frac{40\sqrt{5}x^{3}y^{2}}{\frac{3}{2}}$	$(j) \frac{a^2 x}{24}$
$(k) \frac{y^{\frac{1}{4}}}{y^{\frac{1}{4}}}$	() <u>B</u>		. y		Z ²	b⁰y⁵
(K) <u>1</u> X ²⁴	(1) a²					
6. (a) 1.319 507 91 (e) 0.341 278 752	(b) 0.172 (f) 5.179	2 427 286 9 474 68		(c) 90.597	458 (d) 2.080 083 82
7. (a) 3^2 (b) 7 ⁴	(c) 3 ²		(d) 14 ⁻³		
EXERCISE 1.12	*					
1. (a) 5 ()	b) 3	(c)6		(d) 2	(e) 4	(f)2
2. (a) 4 (1	b) 3	(1)4 (c)3		(j)2 (d)16	(a) 2	(f) A
(g) 6 (l	h) 2	(i) x ∈ N	1	$(j) x \in \mathbb{N}, x$	x even	(1) 4
$(a) \ge (b) = 0, \pm 2, \pm 4, \pm 4$	±6	(b) -7 (e) 2			(c) 5	
(g) 1		(b) x ∈ I			(i) 4	
$(j) - \frac{5}{2}$						
	b) $-\frac{1}{3}$	(c) <u>2</u>		(d) $-\frac{1}{4}$	(e) <u>1</u>	(f) -2
4. (a) $\frac{3}{2}$ (t	0	-				
$\begin{array}{c} 4. (a) \frac{3}{2} \\ (g) \frac{16}{15} \\ (f) \end{array}$	r) — 1	(i).4		(j) -2	(k) 0	(1) 4

420 FOUNDATIONS OF MATHEMATICS 11

1	-YPICISP VAL	2		2
<u>.</u>	Write each expres	ssion as a single po	wer.	_
	0. Write cach onprov	$(2^2)(3^{\frac{3}{2}})$	c) $(3^2)(3^{\frac{5}{2}})$	d) $(3^2)(3^{\frac{7}{2}})$
	a) $(3^2)(3^2)$	b) (3)(32)		
~	7 Write each expre	ssion as a single po	wer.	-
)	7	h) $\frac{7}{7}$	c) $\frac{7}{5}$	d) $\frac{7}{-7}$
	a) $\frac{1}{7^{\frac{1}{4}}}$	$7\frac{3}{4}$	74	74
. /	8 Knowledge/Und	lerstanding Write	each expression as	a single power.
v	Then evaluate the	e power.		
	(50.2)(51.2)	h) $(3^{2.75})(3^{1.15})$	c) $\frac{2^{8.66}}{2^{3.12}}$	d) $(7^{1.5})^{0.4}$
	a) (5)(5)		23.12	
	ß			
1	Solve each equal	tion.		
¥	9. Solve cach equa	b) $2x^{-1} - 8$	c) $3^{x-5} = 9$	d) $5^{x+3} = 25$
	a) $2^{x+1} = 4$	$u_{j} 2 = 0$	$-x^{2x-1} - 0$	h) $9^{1-2x} = 81$
s	e) $4^{x+2} = 16$	f) $2^{2x+1} = 8$	g) 5 - 9	nj >
1	(1) a) Solve each ec	mation.		
¥	i) $4^x - 8^{x+3}$	ii) $4^x = 8^{x+2}$	iii) $4^x = 8^{x+1}$	iv) $4^x = 8^x$
	$4^{x} - 8^{x-1}$	vi) $4^x = 8^{x-2}$	vii) $4^x = 8^{x-3}$	viii) $4^x = 8^{x-4}$
	v) + - 0	mattion from part a	Explain how you	solved the equation.
	b) Choose one e	quation nom part a	. Lispania in g	$\alpha x = 2$ $\alpha x = 1$
\checkmark	11. Thinking/Inqui	ry/Problem Solvir	g Consider the equ	ation $8^{n-2} = 64^{n-2}$.
\frown	Solve the equation	ion in two different	ways.	
		- 4:		
	12 Solve each equa	ition.	$x^{2x} = 12(3^{x})^{-1}$	27 = 0
	a) $2^{2x} - 9(2^x) + $	8 = 0	$1) 5^{-1} - 12(5)$	127 = 0
	c) $2^{2x} - 2(2^x) $	8 = 0	d) $4^{2x} - 15(4^{x}) - 15(4^{x})$	-10 = 0
	e) $2^{2x} - 18(2^x)$	+32 = 0	f) $3^{2x} + 3^x - 2 =$	= 0
	(a) $3^{2x} - 6(3^x) + 6(3^x)$	9 = 0	h) $4^{2x} - 17(4^x)$ -	+16 = 0
	y = 0(3)	ý 0 ý		
	$1) 4^{-1} - 10 = 0$			- 1 1.4
\checkmark	13. Application S	cientists have meas	ured many bird eggs	s. From these data,
	they have estab	lished approximate	formulas to represe	ent various
	measurements.	In the two formula	s below, <i>m</i> represen	ts the mass of the
	bird in grams.	The formulas give a	average results. The	properties of a
	particular egg	from a particular bi	rd may differ from t	the calculated result.
	Mass of the eq	o e orams:	$e = 0.277 m^{0.770}$	
	Mass of the eg	oshell, s grams;	$s = 0.0482e^{1.132}$	
	a) Liss the first	formula Write an	expression for the n	nass of the egg as a
	a) Use the first	the mass of the bird	expression for the	
				ne mass of the eggshell
and the second	b) Use the sec	ond formula. Write	an expression for u	10 111000 01 010 0500000
NO-PARTY	as a fraction	1 of the mass of the	egg.	

16 APPLYING THE EXPONENT LAWS

Exercise 1.6 7. a) $7^{\frac{1}{2}}$ b) $7^{\frac{1}{2}}$ c) $7^{\frac{1}{2}}$ d) 7																						
7. a) $7^{\frac{2}{2}}$ b) $7^{\frac{2}{4}}$ c) $7^{\frac{2}{$		Ē	Xe	ercis	e	1.	6								•				. .			
8. a) 9.52 b) 72.57 c) 46.53 d) 3.21 9. a) $1 - b$ d) 4 c) 7 c) $1 - 1$ 9 0 5 1 a) 25 b) 72.57 c) 46.53 d) 3.21 10 a) $1 - 9$ ii) -6 iii) 0 iv) 3 10 a) $1 - 9$ ii) -6 iii) 0 iv) 3 11 a) 1.5 b) -05 12 a) 0.277 m^{-50} b) $0.0482 e^{0.13}$ 13 a) $0.019, 0.048, 0.266$ b) $0.133, 0.088, 0.046$ 14 $0.0113 \text{ m}^{-4.01}$ 15. $\overline{\frac{1997}{1983}} - \frac{1}{221}}{\frac{1993}{1983}} - \frac{1}{2445}}{\frac{1993}{1993}} - \frac{1}{3668}$ 15. $\overline{\frac{1997}{1983}} - \frac{1}{3268}}{\frac{1994}{1993}} - \frac{1}{3668}}$ 16. $\overline{\frac{1977}{1983}} - \frac{1}{3000}}{\frac{1995}{1993}} - \frac{1}{3668}}$ 17. a) i) 2.807 ii) 0.336 18. a) 19.95 b) 190.5 c) 195.6 d) 19.950 b) 10.019 b) 15 c) 32 d) -625 c) 10.995 c) $0.019.95$ b) 190.5 c) 195.6 d) 19.950 18. a) 19.95 b) 190.5 c) 195.6 d) 19.950 19. a) $\frac{1}{2807}$ b) $\frac{1}{252}$ d) -625 b) $0.0019.95$ b) 190.5 c) 195.6 d) 19.950 18. a) 19.95 b) 190.5 c) 195.6 d) 19.950 2 a) 2.807 b) 15.232 c) 2.2326 d) -625 b) $0.0019.95$ c) $0.019.95$ c) $0.019.95$ c) $0.019.95$ c) $0.019.95$ 2 a) 2.609 b) 15.335 c) 823.96 1. a) $\frac{1}{2} \frac{1}{2}$ b) $\frac{1}{2}$ c) $\frac{1}{2}$ d) $-\frac{1}{2}$ d) $\frac{1}{4}$ 2 c) $1.5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31$ 2 c) 2.609 b) $15.16.146$ 5 c) 3.2365 b) 15 2 d) 2.609 b) 15.535 c) 156.146 5 d) 2.000 b) 5.18 (0.01 195 c) 2.100 c) $\frac{1}{2}$ c) $\frac{1}{22.9}$ c) $\frac{1}{2.9}$ c) $\frac{1}{22.9}$ c) $\frac{1}{2.9}$ c) $$		7.	a)	$7^{\frac{3}{4}}$	b)	$7^{\frac{1}{4}}$	с	$) 7^{-\frac{1}{4}}$	4	d)	$7^{\frac{3}{4}}$	-	-	i ne	Sum	or an	Arithm	etic	Series			
8. a) 9.52 b) 72.57 c) 46.53 d) 3.21 1. a) 30 b) 90 c) -30 d) -40 9. a) 1 . b) 4 c) 7 d) -1 a) 1.5 b) -05 10. a) 0 -9 ii) -6 iii) 0 iv) 3 iii) 0 iv) 3 12. a) 0.277 m ⁴²⁰ b) 0.0482 e ⁰¹³ 5. a) 400 b) 556 c) -1092 d) -168 13. a) 0.019,0048,0206 b) 0.133,0088,0046 6. a) 210 b) 556 c) -1092 d) -168 14. 0.0113m ^{-0.131} 5. a) 290 0 500 d) 115 15. $\frac{1977}{1990}$ $\frac{2021}{201}$ 1994 $\frac{2021}{1993}$ $\frac{2021}{322}$ 1994 $\frac{2001}{201}$ $\frac{1977}{2000}$ 16. $\frac{1977}{1990}$ $\frac{2037}{322}$ 17. a) 1) 2.807 ib) 150 057 d) 1995 c) 18. a) 19.95 b) 1995 c) 1095 d) 1995 c) $\frac{1995}{1992}$ 1992 $\frac{1992}{201}$ 2001 $\frac{1997}{1992}$ 18. a) 19.95 b) 1995 c) 2105 d) 1995 c) 1992 $\frac{1992}{201}$ 2011 $\frac{1992}{201}$ 2011 $\frac{1992}{201}$ 18. a) 1995 b) 1995 c) 21095 c) $\frac{1992}{201}$ 1992 $\frac{1992}{201}$ 1992 $\frac{1992}{201}$ 1992 $\frac{1992}{201}$ 1992 $\frac{1992}{201}$	\sim		,		-					· .		. E	=xerc	ise	s							
9. a) 1 b) 4 c) 7 c) -1 9 a) 1 b) 4 c) 7 c) -1 9 a) 1 b) 4 c) 7 c) -1 9 a) 1 b) 4 c) 7 c) -1 15 a) 0.019,0.048,0.26 b) 0.0133,0.088,0.046 14 a) 0.013 m ^{4.18} 15 $\frac{12}{1286} + \frac{1}{2212} + \frac{1}{222} + \frac{1}{222} + \frac{1}{222} + \frac{1}{22} + \frac{1}{2} + \frac{1}{2}$		8.	a)	9.52	b)	72.5	7 c) 46.5	53	d)	3.21	1	l. a	a) (30	b)	90	. c)	-30	d)	-40	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		9.	a)	1 .	b)	4	c) 7		d)	-1	2	2. a	ı)	153	b)	385	c)	244	d)	441	
10. a) $\hat{n} - \hat{g}$ $\hat{n} - \hat{g}$ $\hat{n} - \hat{g}$ $\hat{n} = 0$ \hat{n}			e)	0	I)	1	g) 1.5		n) _	-0.5	3	3. a	i) (375	b)	-98	c)	35 000	d)	-357	
12. a) $0.277 \text{ m}^{2.3}$ b) $0.0482 e^{3.12}$ 13. a) $0.019, 0.048, 0.206$ b) $0.133, 0.088, 0.046$ 14. $0.0113 \text{m}^{2.138}$ 15. $\boxed{\frac{1977}{2200}}$ $\boxed{1983} \ 2241}$ $\boxed{1983} \ 2241}$ $\boxed{1994} \ 500$ 1. a) 146 ii -598 iii 3604 iv -110 9. a) 12800 ii -637 o 646 d 246.5 083.5 f $-137.61. b b Pays more over the summer.\frac{\pi^2 + \pi}{2}13. a) 63 b) 69014. 27215. a) 44 b) 15 c) 34516. \frac{\pi^2}{2} \frac{\pi}{2}17. a) 102.807 th 0.33518. a) 19.95 b) 199.5 c) 199.5 d) 19.950b) 15385 c) 228.85 c) Year 5 d) 529.985 c) Year 5 d) 529.91515. a) 2460 b) 51800019. -59,3820. 9021. 5,7,9,11,13,15,17,19,21,23,25,27,29,3124. a) 2266 b) 645. a) 29.365 b) 166.1465. a) 29.325 b) 166.1465. a) 29.325 b) 166.1465. a) 6 b) 0$		10.	a)	i) -9 v) 3	ii) vi)	6 6	ii v	i) 0 ii) 9		iv) viii	. 3)12	4	i. a	ı) :	1.04	b)	55:56	c)	-109.2	d)	-168	
13. a) 0.019, 0.048, 0.206 b) 0.133, 0.088, 0.046 14. 0.0113m ⁴¹³⁴ 15. $\frac{1977}{12900}$ 15. $\frac{1977}{12930}$ 16. $\frac{1977}{12930}$ 1994 1994 1994 1994 1995 1994 1994 1995 1994 1995 1994 1995 1994 1995 1994 1995 10. 01995 1995 1995 1995 1995 1995 1995 1995 1995 1995 1995 10. 01995 1995 1995 10. 01995 19. 001995 19. 001995 19. 001995 19. 001995 19. 001995 19. 001995 19. 001995 19. 001995 10. 00195 10. 00195 10		12.	a)	0.277 m ⁻	0.23		b) 0.04	482 e ⁰	.132	`	5	5. a	ı) 4	400	b)	590	c)	970	d)	115	
14. 0.0113m ^{-0.100} (9) (0.103, 0.000, 0.010) 14. 0.0113m ^{-0.100} (9) (0.103, 0.000, 0.010) 15. $\frac{Yarr}{1090} \frac{1}{221}$ 1983 245 1986 271 1993 332 1994 500 1992 332 1994 500 1995 332 1994 500 1995 1995 332 1995 1199 2001 3900 17. a) 1) 2.807 18. a) 19.25 b) 190.5 c) 1995 a) 0.001 995 b) 0.00011995 1995 1199 2001 3900 17. a) 1) 2.807 18. a) 19.95 b) 190.5 c) 1995 a) 0.001 995 b) 0.00011995 Self-Check 1.5-16 1. a) b) 15 c) 32 d) -625 c) 1 3 $\frac{1}{2}$ g) $\frac{1}{9}$ b) -125 2. a) 2.609 2. a) 2.609 b) 15.385 c) 2.828,956 d) 0.0001 995 g) 0.001 995 g) 0.001 995 b) 0.0001 995 g) 0.001 995 g) 0.001 995 b) 0.0001 995 g) 0.001 995 g) 0.001 995 b) 0.0001 995 g) 0.001 995 g) 0.001 995 g) 0.001 995 b) 0.0001 995 g) 0.001 995 g) 1.5385 c) 828 885 c) Year 5 d) \$209 195 18 a) \$209 0b) \$18 000 19 -59, 38 20 90 21 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31 22 90 21 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31 22 30 20 195 18 200		13	a)	0.019.0	048	0.204	5 h	0.13	13 0 0	188	0.046	6	б. a	.) 2	210	Б)	320	c).	-290	d)	180	
15. $\boxed{\frac{\text{Year}}{\frac{1977}{200}}} \xrightarrow{\text{Population}}{\frac{1983}{245}} \xrightarrow{245}} \xrightarrow{10}{25005} \xrightarrow{10}{0} \xrightarrow{10}{5005} \xrightarrow{10}{0} \xrightarrow{10}{5005} \xrightarrow{10}{0} \xrightarrow{10}{5005} \xrightarrow{10}{0} \xrightarrow{10}{5005} \xrightarrow{10}{0} \xrightarrow{10}{5005} \xrightarrow{10}{0} \xrightarrow{10}{5005} \xrightarrow{10}{0} \xrightarrow{10}{10} \xrightarrow{11}{10} \xrightarrow{11}{10} \xrightarrow{11}{10} \xrightarrow{11}{10} \xrightarrow{11}{10} \xrightarrow{11}{10} \xrightarrow{10}{10} \xrightarrow{11}{10} \xrightarrow{11}$		14.	0.0	0113m ^{-0.128}		0.200) - 0.12	, 0.0	/00,	0.040		e	() <u>+</u>	579	f)	37.5					
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5. a) 29.365b) 166.14624. a) 125b) 156. a) 6b) 025. $d = 2, a = 16; 16, 18, 20, 22, 24, 26, 28, 30, 32, 34$ $d = 4, a = 7; 7, 11, 15, 19, 23, 27, 31, 35, 39, 43$	j.	4.	a)	256			b)	64					0)	ا حد								
6. a) 6 b) 0 $25. d = 2, a = 16; 16, 18, 20, 22, 24, 26, 28, 30, 32, 34 \\ d = 4, a = 7; 7, 11, 15, 19, 23, 27, 31, 35, 39, 43$		5.	a)	29.365			b)	166.1	46			24	. a)	12	.5			b)	15			
		б.	a)	6			b)	0				25	. d = d =	= 2, = 4,	a = 16; a = 7; 7	16, 1 , 11,	8, 20, 22 15, 19, 2	, 24, 3, 27	26, 28, 30 , 31, 35, 3	, 32, 9, 43	, 34 3	