Module 1 Math www.JAR66.de

Numbers

Natural Numbers 1,2,3,4.... Even Numbers 2,4,6,8...

Odd Numbers 1,3,5,7.....

Whole Numbers ...-3, -2, -1, 0 , 1 ,2 ,3 , ...

Rational Numbers are whole Numbers and Fractions ,fractions may be e.g. $\frac{1}{2}$ or a decimal fraction 0.5

...-3,..-2$\frac{1}{2}$,..-2,-1,-$\frac{1}{2}$, 0 , $\frac{1}{2}$, 1 , 1$\frac{1}{2}$,2 , 2$\frac{1}{2}$,3 , ...

$\frac{1}{2}$ - one is the Numerator and two is the Denominator

Real Numbers Like rational numbers plus not ending fractions. e.g.$\frac{1}{3}$ does not terminate as a decimal fraction $0.333\overline{3}$.... pi or square root of two $\sqrt{2}$ or three $\sqrt{3}$ etc.. $0.33\overline{3}$... $\overline{3}$ as last digit means that the 3 continues forever.

Rules:

minus x minus = positive result (-2) x (-3) = (+6) or 6

minus x positive = negative result (-2) x (+3) = (-6)

minus minus = positive result -(-7) = 7 or 5 - (-2) = 7

negative number plus a positive number = result may be positive or negative (-5) + 7 = 2 or (-5) + 3 = (-2)

positive number minus a positive number = result may be positive or negative 7 - 5 = 2 or 7 - 9 = (-2)

Sequence of calculation :

First you calculate contents in brackets (3+5), second multiplication or division 3 x 5, last addition or substraction. (3+5) x 3 x 5 + 3 - 5 = 118

1. Law of signs. $++ = +$, $+- = -$, $-+ = -$, $-- = +$, $\times\times = \times$, $\times\div = \div$, $\div\times = \div$, $\div\div = \times$.
2. Commutative law. $a + b = b + a$, $ab = ba$.
3. Distributive law. $a(b + c) = ab + ac$.
4. Index laws. $a^b \times a^c = a^{b+c}$, $(a^b)^c = a^{bc}$, $(ab)^c = a^c b^c$
5. $a - a = 0$, $a \div a = 1$.

Fractions:
addition $\frac{3}{7} + \frac{22}{7} = \frac{25}{7}$; subtraction $\frac{3}{4}$ - $\frac{1}{4} = \frac{2}{4}$ can be cancelled to $\frac{1}{2}$;
multiplication = numerator x numerator and denominator x denominator
$\frac{3}{4}$ x $\frac{1}{4} = \frac{3x1}{4x4} = \frac{3}{16}$;
division = first fraction multiplied by reciprocal of second fraction $\frac{3}{7} : \frac{5}{8} = \frac{3}{7}$ x $\frac{8}{5} = \frac{3x8}{7x5} = \frac{24}{35}$ mixed numbers are a whole number e.g. 3 and a fraction e.g $\frac{1}{2}$. Convert 3 in the fraction = $\frac{6}{2}$ plus $\frac{1}{2} = \frac{7}{2}$
Cancel = to divide numerator and denominator by same number $\frac{12}{36}$ divide both numerator and denominator by 12 = $\frac{1}{3}$
Expand = to multiply numerator and denominator by same number $\frac{1}{3}$ multiply both numerator and denominator by 12 = $\frac{12}{36}$

To **solve equations** you must know fractions! Equations are like a balance. Whatever you do on one side, you must also do on the other side of the equal sign.
Say you have a formula $3x + 1 = 2 \cdot 5$, you must isolate x on one side.
$3x + 1 = 2 \cdot 5$ | subtract 1 on both sides which gives
$3x = 2 \cdot 5 - 1$ | you can solve the right side to 9 so
$3x = 9$ | you divide both sides by 3 so
$x = 9 : 3 = 3$
In more complex formulas you can cancel or simplify or insert known terms of other formulas etc..

Percent means part of 100 . To calculate a percentage of 5% of 500 you multiply 500 by 0.05 = 25 . To find out 100%, when 25 equals 5% , you can divide 25 by 0.05 or you divide by 5 and multiply by 100.
100% - 45% - 22.5% = 32.5% . The sum is always 100 .

Algebra: One can also use letters instead of numbers
$a + b = b + a$ **commutative law** of addition $1 + 2 = 2 + 1$ is an example .
$(a + b) + c = a + (b + c)$ **associative law of addition**
$(1 + 2) + 3 = 1 + (2 + 3)$ is an example .
$a \cdot b = b \cdot a$ **commutative law of multiplication** you can also write ab = ba
$(a \cdot b) \cdot c = a \cdot (b \cdot c)$ **associative law of multiplication**
$(a + b) \cdot c = a \cdot c + b \cdot c)$ **distributive law**

Powers:
$2 \cdot 2$ may also be written as 2^2 which equals 4 and 2^3 equals $2 \cdot 2 \cdot 2 = 8$.
Roots are the opposite of powers $\sqrt{4}$ (square root of 4) = the number that multiplied by itself equals 4 . The sign for the square root is the $\surd$. I do not want to teach you how to extract roots. In the exam you will get three answers. Multiply the numbers and you will get the result. Say, they are looking for the $\sqrt[3]{27}$ and the answers are 2,3 and 4 . 2·2·2 = 8 , 3·3·3 = 27 which is the result.
Rules of powers and roots $y^{2+3} = y^2 \cdot y^3$ $(y^2)^3 = y^{2 \cdot 3}$ $y^0 = 1$
$y^{-2} = \frac{1}{y^2}$ $y^{\frac{1}{2}} = \sqrt{y}$ $y^{\frac{1}{3}}$ = 3rd root of y or $\sqrt[3]{y}$ $10^2 = 10 \cdot 10$
Logarithm of 10 , $10^2 = 100$ so, the log of 100 is 2, it is simply the number in power. 1000 000 is 10^6 so its log is 6 . Count the 0's to find out the log!!! As you cannot solve other logarithms without a calculator etc., forget about it in the exam :)

Binomial Formulas - You will have at least one of them in the exam - learn them by heart!!!
$(a + b)^2 = a^2 + 2ab + b^2$
$(a - b)^2 = a^2 - 2ab + b^2$
$(a + b)(a - b) = a^2 - b^2$

Formulas and their curves
$Y = a_0 + a_1X$ is a straight line where a_0 is the intercept of Y-axis and a_1 is the gradient or slope. Sometimes they are also named $Y = mX + n$ e.g. $Y = 3X + 5$ this means the graph is a ascending line from left to right for one unit of Y it needs three units of X . The line goes through +5 of Y-axis at X=0.
$Y = a_0 + a_1X + a_2X^2$ is a parabola
$Y = a_0 + a_1X + a_2X^2 + a_3X^3$ is a cubic curve
$Y = a_0 + a_1X + a_2X^2 + a_3X^3 + a_4X^4$ is a quadratic curve
$Y = 1/(a_0+a_1X)$ or $\frac{1}{Y} = a_0 + a_1X$ is a hyperbola
$Y = ab^x$ or $\log Y = \log a + X\log b = a_0 + a_1X$ is an exponential curve

Decimal to Hex Table															
Dec		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E
Dec	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Hex	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D
Dec	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Hex	1E	1F	20	21	22	23	24	25	26	27	28	29	2A	2B	2C
Dec	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Hex	2D	2E	2F	30	31	32	33	34	35	36	37	38	39	3A	3B
Dec	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74
Hex	3C	3D	3E	3F	40	41	42	43	44	45	46	47	48	49	4A

B I N A R Y														
2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0		10^3	10^2	10^1	10^0
512	256	128	64	32	16	8	4	2	1		1000	100	10	1
									0					0
									1					1
								1	0					2
								1	1					3
							1	0	0					4
							1	0	1					5
							1	1	0					6
							1	1	1					7
						1	0	0	0					8
1	0	1	1	0	0	1	0	1				3	5	7
1	1	1	1	1	1	0	1	1	1		1	0	1	5