

Abe Mirza**Solving Equations****Algebra**

1. Solve the equation $14y + 26y + 5 = 39y$

2. Solve the equation $x - 0.9x + 0.1 = 0.3(x + 1)$

3. Solve the equation $3n + 14 - 22 - 12 = 6n$

4. Solve the equation $2(y + 5) - 4 = 6(y + 2) + 2$

5. Solve the equation $\frac{2}{4}x + 1 = \frac{1}{4}x + 6$

6. Solve the equation $\frac{2x}{3} + \frac{x}{2} = -\frac{3}{2} + \frac{x}{3}$

7. Solve the equation $6(4x + 1) = 2(2x + 3)$

8. Solve the equation $\frac{1}{6}(y + 18) + \frac{1}{3}(2y + 3) = y + 3$

9. Solve the equation $-(6k - 5) + (-5k + 8) = -3$

10. Solve the equation $0.30(x + 15) - 0.40(x + 25) = 25$

11. Solve the inequality $2x - 5 > -2x + 6$

12. Solve the inequality $1 < 2x - 7 < 9$

13. Solve the inequality $8(t - 3) < -4(t - 3)$

Answers

1. $y = -5$ 2. $x = -1$ 3. $n = -20/3$ 4. $y = -2$ 5. $x = 20$ 6. $x = -9/5$ 7. $x = 0$

8. $y = 6$ 9. $k = 16/11$ 10. $x = -305$ 11. $x > 11/4$ 12. $4 < x < 8$ 13. $t < 3$

Abe Mirza**Slope and Equation of a Line****Algebra**

Given two points $(x_1, y_1), (x_2, y_2)$, The **slope** of the line that goes through these two points will be

$$\text{Slope} = m = \frac{\text{Change in } y}{\text{Change in } x} = \frac{\text{Rise}}{\text{Run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

If $m > 0$ line always goes from **South West** to **North East**

If $m < 0$ line always goes from **North West** to **South East**

If $m = 0$ line is always (**Horizontal Line**) _____

If $m = \text{undefined}$ line is always (**Vertical Line**) |

Example: Find the slope of the lines that through points $(-7, 6)$ and $(4, 5)$ $m = \frac{5 - 6}{4 - (-7)} = \frac{-1}{11}$

Practice: Find the slope of the lines through points $(-8, -6)$ and $(-4, 15)$ $m =$

Slope-Intercept Form: $y = mx + b$ $m =$ Slope, $b =$ y-intercept

Note: If two lines have the **same slope** they will be **parallel**. $y = -8x + 12$ $y = -8x - 5$

Vertical Lines: $x = a$, $x = 3$, $x = -4$ **Horizontal Lines:** $y = b$, $y = 7$, $y = -2$

Finding x and y intercepts in an equation of line:

Finding **x-intercept**, let $y = 0$, solve for x \Leftrightarrow Finding **y-intercept**, let $x = 0$, solve for y

Example: Find x and y intercepts in equation $2x - 3y = 12$

Finding **x-intercept**, let $y = 0 \Rightarrow 2x - 3y = 12 \quad 2x - 0 = 12, \quad 2x = 12, \quad x = 6$

Finding **y-intercept**, let $x = 0 \Rightarrow 2x - 3y = 12 \quad 0 - 3y = 12, \quad -3y = 12, \quad y = -4$

Example: Find x and y intercepts in equation $y = -\frac{1}{2}x + 5$ Ans: $x = 10, \quad y = 5$

Perpendicular lines: their slopes are negative reciprocal of each other $m_1 = \frac{-1}{m_2}, \quad y = 2x + 3, \quad y = \frac{-1}{2}x + 3$

How to find the Equation of a line $y = mx + b$			
Case	Given	How	Example
1	$m =$ Slope, $b =$ y-intercept	Substitute them into equation	$m = -2, b =$ y-intercept $= 3$ Substitute them into equation $y = -2x + 3$
2	$m =$ Slope, and a point $= (x, y)$	Substitute them into equation $y = mx + b$ and then solve for b	Find the equation of the line that passes through point $(-8, 6)$ and its slope $= m = -2$ $6 = -2(-8) + b, \quad 6 = 16 + b, \quad b = -10$ Substitute them into equation $y = -2x - 10$
3	Passes through two points $(x_1, y_1), (x_2, y_2)$	First find slope and then use (x_1, y_1) like case 2	Find the equation of the line that passes through points $(-5, 8)$ and $(5, 18)$ $m = \frac{18 - 8}{5 - (-5)} = \frac{10}{10} = 1, \quad y = mx + b$ $8 = 1(-5) + b, \Rightarrow 13 = b \quad y = x + 13$
4	$m = 0$ and passes through point (x_1, y_1)	Always a Horizontal Line: $y = 0 + b = y_1$	Find the equation of the line that passes through point $(-4, -6)$ and its slope $= m = 0$ $y = 0 + b = y_1 = -6 \quad y = -6$
5	$m = \text{undefined} = \frac{\text{Number}}{0}$ and passes through point (x_1, y_1)	Always a Vertical Line: $x = x_1,$	Find the equation of the line that passes through point $(3, 7)$ and its slope $= m = \text{undefined}$ A vertical line, so its equation is $x = 3$
6	Passes through point (x_1, y_1) and is parallel to a given line	The new slope $= m$ of the parallel line and then do like case 2	Find the equation of the line that passes through point $(-4, 7)$ and is parallel to its line $y = -2x - 10$ The line has slope of $= m = -2$ $7 = -2(-4) + b, \quad 1 = 8 + b, \quad b = 1$ $y = -2x + 1$
7	Passes through point (x_1, y_1) and is perpendicular to a given line	The new slope will be the $m_2 = -1/m_1$ of the given equation, Having slope m_2 and (x_1, y_1) then do like case 2	Find the equation of the line that passes through point $(-4, 7)$ and is perpendicular to its line $y = -2x - 10$ The line has slope of $= m = -1/-2 = 1/2 = .5$ $7 = .5(-4) + b, \quad 7 = -2 + b, \quad b = 9 \quad y = .5x + 9$

- Find the equation of a line that

P.1) passes through point $(0, 1)$ and its slope $= m = -1$

Ans: $y = -x + 1$

P.2) passes through point $(-9, 4)$ and its slope $= m = \frac{2}{3}$

Ans: $y = \frac{2}{3}x + 10$

P.3) passes through points $(3, 5)$ and $(8, 15)$

Ans: $y = 2x - 1$

P.4) passes through points $(-1, -3)$ and $(2, -1)$

Ans: $y = \frac{2}{3}x - \frac{7}{3}$

P.5) passes through points (0,3) and (5,0)

Ans: $y = -\frac{3}{5}x + 3$

P.6) passes through point (3,0) and its y intercepts (0,-1/5)

Ans: $y = \frac{1}{15}x - \frac{1}{5}$

P.7) passes through point (-2,-3) is parallel to $3x + 2y = 5$

Ans: $y = -\frac{3}{2}x - 6$

P.8) passes through point(0,3) and **perpendicular** to $3x + 2y = 5$

Ans: $y = \frac{2}{3}x + 3$

P.9) passes through point (-3,5) and undefined slope

Ans: $x = -3$

P.10) passes through point (-2,-3) is parallel to x axis

Ans: $y = -3$

P.11) passes through point (-2,-3) is parallel to y axis

Ans: $x = -2$

P.12) passes through point (5,4) is perpendicular to x axis

Ans: $x = 5$

P.13) passes through point (5,4) is perpendicular to y axis

Ans: $y = 4$

	Rule	Form	Example	Practice
1	Product	$a^m a^n = a^{m+n}$	$a^4 a^7 = a^{11}$, $a^{-8} a^{15} = a^7$	$a^6 a^{13} =$, $a^{-5} a^{12} =$
2	Quotient	$\frac{a^m}{a^n} = a^{m-n}$	$\frac{a^8}{a^3} = a^5$, $\frac{a^3}{a^{11}} = a^{3-11} = a^{-8}$	$\frac{a^{14}}{a^5} =$, $\frac{a^5}{a^9} =$
3	Power	$(a^m)^n = a^{mn}$	$(a^2)^7 = a^{14}$, $(a^{-3})^{-4} = a^{12}$	$(a^{-5})^3 =$ $(a^{-3})^{-4} =$
4	Power of Product	$(ab)^n = a^n b^n$	$(2x)^3 = 2^3 x^3$, $(5b^2)^3 = 5^3 b^6$	$(4b)^6 =$, $(a^3 b^{-2})^{-4} =$
5	Power of Quotient	$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$	$\left(\frac{3}{2}\right)^5 = \frac{3^5}{2^5}$, $\left(\frac{2^3}{3^4}\right)^2 = \frac{2^6}{3^8}$	$\left(\frac{5}{3}\right)^7 =$, $\left(\frac{4^{-3}}{5^4}\right)^{-2} =$
6	Zero Exponent	$a \neq 0$, $a^0 = 1$	$2^0 = 1$, $(-3)^0 = 1$, $\left(\frac{3}{7}\right)^0 = 1$	$7^0 =$, $(-18)^0 =$, $\left(\frac{17}{5}\right)^0 =$
7	Negative Exponent	$a^{-n} = \frac{1}{a^n}$	$a^{-3} = \frac{1}{a^3}$, $4^{-5} = \frac{1}{4^5}$	$x^{-7} =$, $(-3)^{-5} =$
8	Negative Exponent	$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$	$\left(\frac{2}{3}\right)^{-4} = \left(\frac{3}{2}\right)^4$, $\left(\frac{7}{4}\right)^{-3} = \left(\frac{4}{7}\right)^3$	$\left(\frac{1}{5}\right)^{-3} =$, $\left(\frac{9}{1}\right)^{-2} =$
9	Switching Negative Power	$\frac{a^{-m}}{b^{-n}} = \frac{b^n}{a^m}$	$\frac{a^{-2}}{b^{-3}} = \frac{b^3}{a^2}$, $\frac{2^{-8}}{b^{-6}} = \frac{b^6}{2^8}$	$\frac{7^{-2}}{x^{-3}} =$, $\frac{3^{-3}}{3^{-8}} =$
10	Fractional Exponent	$a^{\frac{1}{n}} = \sqrt[n]{a}$	$a^{\frac{1}{3}} = \sqrt[3]{a}$, $7^{\frac{1}{4}} = \sqrt[4]{7}$	$9^{\frac{1}{2}} =$, $x^{\frac{1}{9}} =$
11	Fractional Exponent	$a^{\frac{m}{n}} = \sqrt[n]{a^m}$	$3^{\frac{5}{2}} = \sqrt[2]{3^5}$, $x^{\frac{3}{7}} = \sqrt[7]{x^3}$	$11^{\frac{6}{7}} =$, $b^{\frac{11}{5}} =$

Factorization

Basic

$$18x + 36 = 18(x + 2)$$

$$65y^{10} + 35y^6 = 5y^6(13y^4 + 7)$$

$$8m^3n + 24mn^3 = 8mn(m^2 + 3n^2)$$

$$13y^8 + 26y^4 - 39y^2 = 13y^2(y^6 + 2y^2 - 3)$$

Grouping $p(p + 4) + 3(p + 4) = (p + 4)(p + 3)$

$$18r^2 + 12ry - 3xr - 2xy = 6r(3r + 2y) - x(3r + 2y) = (3r + 2y)(6r - x)$$

2 Terms $a^2 - b^2 = (a + b)(a - b)$

$$9x^2 - 25y^2 = (3x + 5y)(3x - 5y)$$

$$16k^4 - 1 = (4k^2 + 1)(4k^2 - 1) = (4k^2 + 1)(2k + 1)(2k - 1)$$

3 Terms $x^2 + bx + c$ when $Sum = b$ and $Product = c$

$$x^2 + 5x + 6 \quad S = 5 \quad P = 6 \quad 2, 3$$
$$(x + 2)(x + 3)$$

$$x^2 - 2x - 15 \quad S = -2 \quad P = -15 \quad 3, -5$$
$$(x + 3)(x - 5)$$

3 Terms $ax^2 + bx + c$ when $Sum = b$ and $Product = ac$

$$4x^2 + 3x - 10 \quad S = 3 \quad \text{and} \quad P = 4(-10) = -40 \quad 8, -5$$

$$4x^2 + 8x - 5x - 10 = 4x(x + 2) - 5(x + 2) = (x + 2)(4x - 5)$$

$$21m^2 + 13x + 2 \quad S = 13 \quad \text{and} \quad P = 21(2) = 42 \quad 7, 6$$

$$21m^2 + 7m + 6m + 2 = 7m(3m + 1) + 2(3m + 1) = (3m + 1)(7m + 2)$$

3 Terms $ax^2 + 2abx + c^2$ **Two Squared Terms (Check doubling effect)**

$$x^2 + 10x + 25 = (x + 5)^2$$

$$3x^2 - 48x + 192 = 3(x^2 - 16x + 64) = 3(x - 8)^2$$

$$49x^2 - 28xy + 9y^2 = (7x - 3y)^2$$

$$m^2 + \frac{2}{3}m + \frac{1}{9} = \left(m + \frac{1}{3}\right)^2$$

Practice problems (Factor each problem)

1. $15x^3 - 30x^2$

2. $100a^5 + 16a^3$

3. $x^6y^2 + 5x^4y^3 - 6xy^4 + 10xy$

4. $3a^3 + 3ab^2 + 2a^2b + 2b^3$

5. $c(x + 2) - d(x + 2)$

6. $x^2 + 15x + 44$

7. $x^2 + 6x - 27$

8. $x^2 - 14x + 24$

9. $n^2 - 12n - 35$

Answers

1. $15x^2(x-2)$ 2. $4a^3(25a^2+4)$ 3. $xy(x^4y+5x^3y^2-6y^3+10)$
4. $3a(a^2+b^2)+2b(a^2+b^2)=(a^2+b^2)(3a+2b)$ 5. $(x+2)(c-d)$ 6. $(x+4)(x+11)$ 7. $(x+9)(x-3)$
8. $(x-12)(x-2)$ 9. *Prime*

Practice Test (Exponents, Polynomials, Factoring)

Simplify the expression

1. $x^3x^{-5}x^{-14}$ 2. $\frac{-2t^3}{t^{-15}}$ 3. $\frac{(5^{-2})^3}{5^{-4}}$ 4. $\frac{10^{10}}{0}$ 5. $\frac{y^{-12}}{y^4}$ 6. $(10y)^9(10y)^{-8}$
7. $-((8)^{-2})$ 8. $(3)^{-0}-(-23)^0$ 9. Add $(2y^2-8y+8)+(-3y^2+2y+3)-(y^2+3y-6)$
10. $\frac{k^{-9}k^{-5}}{k^2k^{-7}}$ 11. $(3a^{-3}b^2)(2a^3b^{-5})$ 12. $5^{-1}+10^{-1}$ 13. $(-3r^{-3})^{-3}$
14. $(\frac{x^4y^{-2}}{x^3})^{-3}$ 15. $\frac{(m^{-6}n^7)^{-2}}{m^2n^5}$ 16. $\frac{(a^{-3}b^2)^2}{2(a^4b^3)^{-1}}$ 17. Multiply $(-4r+11)(2r+3)$
18. Multiply $(7x+8s)^2$ 19. Multiply $(m+9)(3m+2)$
20. Multiply $(3x+8y)(3x-8y)$ 21. Multiply $(p-2)(p^4-2p^3-3)$
22. $p(x)=-6x^2-18x-2$, then Evaluate. $p(-2)$ 23. Factor $81x^4-121y^4$

Factor problems 24-33

24. $x^2-5x-36$ 25. m^2+m-6 26. $3m^2-147n^2$ 27. $x^2-2x+24$ 28. $42x^2-2x-20$
29. $6x^{-3}-4x^{-2}+9x^2$ 30. $x^2-18x+36$ 31. $2y^2+6yz+5y+15z$ 32. $xy+3x-4y-12$ 33. $m^2-10m+16$
34. Factor $x^2-4x^{-2}+x^{-1}$ 35. Factor $x^{1/2}-4x^{-1/2}+x^{-1}$

Solve for x for problems 36-45

36. $x^2-7x-8=0$ 37. $4x^2=32x$ 38. $x^2+2x=8$ 39. $x^3+x^2-6x=0$ 40. $-x^2-x=-12$
41. Solve by factoring $(x+5)^2-5(x+5)-36=0$ 42. Solve by factoring $(x-3)^2-5(x-3)-36=0$
43. Solve by factoring $(1/x)^2-5(1/x)-36=0$ 44. Solve by factoring $(\sqrt{x-3})^2-5(\sqrt{x-3})-36=0$
45. Solve by factoring $x^4-5x^2-36=0$

Answers

1	$x^{-16} = 1/x^{16}$	16	$b^7 / 2a^2$	31	$(y + 3z)(2y + 5)$
2	$-2t^{18}$	17	$-8r^2 + 10r + 33$	32	$xy + 3x - 4y - 12$
3	$1/25$	18	$49x^2 + 112xs + 64s^2$	33	$(m - 2)(m - 8)$
4	Undefined	19	$3m^2 + 29m + 18$	34	$x^{-2}(x^4 - 4 + x^1)$
5	$1/y^{16}$	20	$9x^2 - 64y^2$	35	$x^{-1}(x^{3/2} - 4x^{1/2} + 1)$
6	$10y$	21	$p^5 - 4p^4 + 4p^3 - 3p + 6$	36	$x = -1, 8$
7	$-1/64$	22	10	37	$x = 0, 8$
8	0	23	$(9x^2 - 11y^2)(9x^2 + 11y^2)$	38	$x = -4, 12$
9	$-2y^2 + 9y + 17$	24	$(x - 9)(x + 4)$	39	$x = -4, 3$
10	$1/k^9$	25	$(m + 3)(m - 2)$	40	$x = -3, 0, 2$
11	$6/ba^3$	26	$3(m + 7n)(m - 7n)$	41	$k^2 - 5k - 36 = 0, x = -9, 4$
12	$3/10$	27	Prime	42	$k^2 - 5k - 36 = 0, x = -1, 12$
13	$-r^9 / 27$	28	$2(3x + 2)(7x - 5)$	43	$k^2 - 5k - 36 = 0, x = -1/4, 1/9$
14	y^6 / x^3	29	$x^{-3}(6 - 4x + 9x^5)$	44	$k^2 - 5k - 36 = 0, x = 84$
15	m^{10} / n^{19}	30	Prime	45	$k^2 - 5k - 36 = 0, x = \pm 3, \pm 2i$

Abe Mirza

Quadratic Equations (QE)

Algebra

$$ax^2 + bx + c = 0$$

Everyone is ignorant, only on different subjects. – Will Rogers

Solving QE $ax^2 + bx + c = 0$ by,

1. **Factoring ZFP,**

$$(x + 3)(x - 5) = 0, \quad (x + 3) = 0, (x - 5) = 0$$

$$x = -3, \quad x = 5$$

2. **The Square root method**

$$(x - a)^2 = b, \quad \sqrt{(x - a)^2} = \pm\sqrt{b}, \quad (x - a) = \pm\sqrt{b}, \quad x = a \pm \sqrt{b}$$

$$(x - 5)^2 = 16, \quad \sqrt{(x - 5)^2} = \pm\sqrt{16}, \quad (x - 5) = \pm 4, \quad x = 5 \pm 4, x = 9, x = 1$$

$$(x + 3)^2 = 13, \quad \sqrt{(x + 3)^2} = \pm\sqrt{13}, \quad (x + 3) = -3 \pm \sqrt{13}, \quad x = -3 \pm \sqrt{13},$$

3. Quadratic Formula for $ax^2 + bx + c = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$x^2 - 6x - 7 = 0 \quad a = 1, b = -6, c = -7$$

$$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(-7)}}{2(1)} = \frac{6 \pm \sqrt{36 + 28}}{2} = \frac{6 \pm \sqrt{64}}{2} = \frac{6 \pm 8}{2}, x = \frac{14}{2} = 7, x = \frac{-2}{2} = -1$$

Practice Problems

- A. Solve by factoring, $3x^2 - 6x = 0$ $x = 0$, $x = 2$
- B. Solve by factoring, $x^2 - 8x = -16$ $x = 4$, $x = 4$
- C. Solve by factoring, $3x^2 - x - 10 = 0$ $x = -5/3$, $x = 2$
- D. Solve by square root method $3x^2 = 108$ $x = 6$, $x = -6$
- E. Solve by square root method $4x^2 = 25$ $x = 5/2$, $x = -5/2$
- F. Solve by square root method $(x - 9)^2 = 36$ $x = 15$, $x = 3$
- G. Solve by square root method $(4x - 3)^2 = 125$ $x = \frac{3 + 5\sqrt{5}}{4}$, $x = \frac{3 - 5\sqrt{5}}{4}$
- H. Solve by square root method $(2x + 1)^2 = 48$ $x = \frac{-1 + 4\sqrt{3}}{2}$, $x = \frac{-1 - 4\sqrt{3}}{2}$
- I. Solve by Quadratic Formula $x^2 - 10x + 16 = 0$ $x = 8$, $x = 2$
- J. Solve by Quadratic Formula $2x^2 + 36x = -34$ $x = -1$, $x = -17$
- K. Solve by Quadratic Formula $x^2 - 4x - 45 = 0$ $x = 9$, $x = -5$
- L. Solve by Quadratic Formula $3x^2 + x - 4 = 0$ $x = 1$, $x = -4/3$
- M. Solve by Quadratic Formula $x^2 + 5x + 3 = 0$ $x = \frac{-5 + \sqrt{13}}{2}$, $x = \frac{-5 - \sqrt{13}}{2}$

Logarithms

Logarithms are different ways of writing exponential equations.

$100 = 10^2$	$.0001 = 10^{-4}$	$128 = 2^7$	$\frac{1}{125} = 5^{-3}$
\Updownarrow	\Updownarrow	\Updownarrow	\Updownarrow
$\log_{10} 100 = 2$	$\log_{10} .0001 = -4$	$\log_2 128 = 7$	$\log_5 \frac{1}{125} = -3$

Rules:

Base $b > 0$, $b \neq 1$

Rules	Name	Example	Practice
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1		$\log_b 1 = 0$	$\log_8 1 = 0$	$\log_{10} 1 = ?$
2		$\log_b b = 1$	$\log_{10} 10 = 1, \text{ Log}_{28} 28 = 1$	$\log_2 2 = ?$
3	Power	$\log_b a^n = n \log_b a$	$\log_{10} 8^3 = 3 \log_{10} 8$	$\log_5 2^6 = ?$
4	Power	$\log_{b^m} a^n = \frac{n}{m} \log_b a$	$\log_8 128 = \log_{2^3} 2^7 = \frac{7}{3} \log_2 2 = \frac{7}{3} (1)$	$\log_{27} 243 = ?$
5	Product	$\log_b a + \log_b c = \log_b ac$	$\log_{10} 7 + \log_{10} 9 = \log_{10} 63$	$\log_5 20 + \log_5 5 = ?$
6	Quotient	$\log_b a - \log_b c = \log_b \frac{a}{c}$	$\log_{10} 12 - \log_{10} 3 = \log_{10} 4$	$\log_5 20 - \log_5 5 = ?$
7		$b^{\log_b a} = a$	$5^{\log_5 8} = 8$	$3^{\log_3 11} = ?$
8	Base 10	When base is 10, we write base as blank.	$\log_{10} 81 = \log 81, \log_{10} x^2 = 2 \log x$	$\log_{10} 20 = ?, \log_{10} yz = ?$
10	Natural Base (e)	When base is (e), we write ln rather log .	$\log_e x = \ln x, \log_e 2 = \ln 2, \ln e = 1$	

Write each as an exponential.

1) $\log_2 32 = 5$ 2) $\log_e x = -2$ 3) $\log_{11} \sqrt{11} = \frac{1}{2}$ 4) $\log_{10} 1000 = 3$ 5) $\log_{10} .001 = -3$

Write each as a logarithmic equation.

6) $10000 = 10^4$ 7) $10^{-2} = \frac{1}{100}$ 8) $5^{\frac{1}{2}} = \sqrt{5}$

Simplify each problem,

9. $\log_{25} 125 =$ 10. $\log_{\frac{1}{2}} 64 =$ 11. $\log_{\sqrt{5}} \frac{1}{5} =$ 12. $\log_{10} .00001 =$ 13. $\log_{0.10} 1000 =$

Solve for x,

14. $\log_9 \frac{1}{27} = x$ 15. $\log_x 27 = 2$ 16. $\log_3 x = -2$ 17. $\log_2 (x+6) = 3$ 18. $\log_6 (x^2 - x) = 1$

Use a calculator to find

19 $\log_4 27 =$ 20. $\log_6 206 =$ 21 $\log_{45} 2004 =$ 22. $\log_{56} 5060 =$

1	2	3	4	5	6	7	8
$32 = 2^5$	$x = e^2$	$\sqrt{11} = 11^{\frac{1}{2}}$	$1000 = 10^3$	$.001 = 10^{-3}$	$\log_{10} 10000 = 4$	$\log_{10} \frac{1}{100} = -2$	$\log_5 \sqrt{5} = \frac{1}{2}$
9	10	11	12	13	14	15	16
$3/2$	-12	-2	-5	-3	-3/2	$\sqrt{27}$	-1/9
17	18	19	20	21	22		
2	-2,3						