

PLACE  
STAMP  
HERE

**LITRONIX, INCORPORATED**  
19000 HOMESTEAD ROAD  
CUPERTINO, CALIFORNIA 95014

Quality Assurance Department



**a guide to  
machine calculation  
litronix 2230  
memory**

# litronix 2230

Thank you for purchasing the Litronix 2230 personal calculator. The Litronix 2230 is made by the people who make the insides of many of the world's electronic hand-held calculators. In fact, we supply 20% of the laboratory-grown (LED) crystals that light the numbers. We also design and supply the logic-chips (they do the actual calculating) and the integrated circuits that tie everything together. Because of this world wide technological and manufacturing leadership, the Litronix 2230 is a personal calculator that combines top quality and good value to serve you.

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## FEATURES



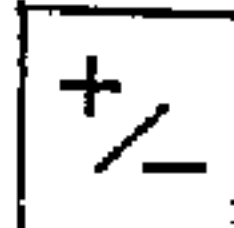

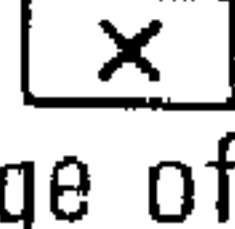
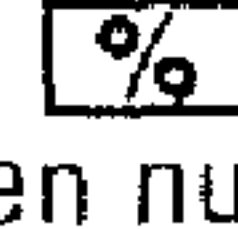

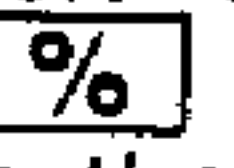

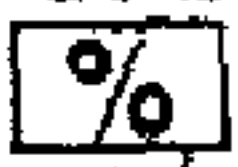

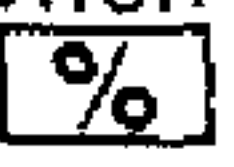
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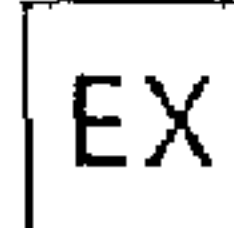

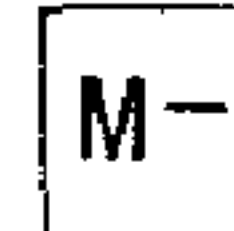
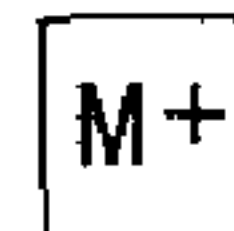
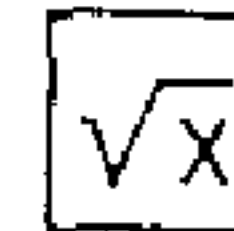
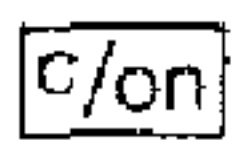



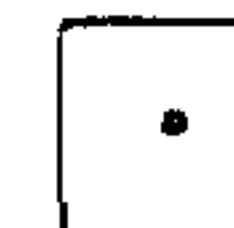
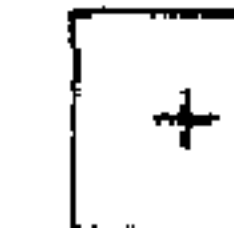


- **Full Accumulating Memory**—Accumulates and recalls subtotals of prior calculations. Any displayed number may be added to or subtracted from data saved in memory. Data in display may be exchanged with data saved in memory at anytime during calculation.
- **Square Root Key**—Provides square root of displayed number with single press of key to full seven digit floating point accuracy.
- **Percent Key**—Provides for percentage, add-on, discount, markup and yield calculations.
- **Algebraic Logic**—Allows entry sequence to be in same order as problem develops.
- **Change Sign Key**—Changes the sign of the number shown in the display.
- **Full Floating Decimal**—Calculator automatically positions decimal point to maintain full 8 digit accuracy.
- **Unconditional One Year Guarantee**—A full one year unconditional guarantee on parts and labor from date of purchase.
- **Overflow Save**—In case of overflow in display, a single press of  $\boxed{C/on}$  clears the overflow condition and allows calculator to continue using the overflowed results divided by  $10^8$ .
- **Automatic Constant**—Performs repetitive addition, subtraction, multiplication and division operations without need to re-enter constant or function.
- **Error Message**—When improper sequence entry is made into calculator, word "Error" will flash on display until  $\boxed{C/on}$  is pressed once.
- **Battery Saving Display Flasher**—After Approximately 50 seconds of non use, display will flash on and off to conserve battery power. The display can be restored by pushing the Change Sign Key  $\boxed{+/-}$  twice.
- **Automatic Power Off**—If power is not turned off for approximately 15 minutes of non use, the calculator will automatically be turned off.
- **Throw Away Batteries**—This calculator uses 3 AA penlight batteries for up to 8 hours of continuous operation. Up to 16 hours of continuous operation can be expected when Alkaline Batteries are used.

- **Optional A.C. Adapter**—This unit is available for use as an option. The internal batteries are automatically disconnected to conserve battery life when the A.C. Adapter is in use.
- **Model 2230R**—This optional model comes with an internal battery pack that provides up to 6 hours of continuous use. The batteries can be recharged in 12-14 hours with the enclosed A.C. Adapter/Charger.

## OPERATING INSTRUCTIONS

### KEYS

-  Initial power on clears calculator, including memory. If last entry was a number, one press clears last entry. If display indicates overflow, one press clears overflow condition. Two presses will clear calculator, but not data saved in memory.
-  Turns calculator off. Once off, all data is erased from calculator, including that which was saved in memory.
-  Changes the sign of the number shown in the display. This key is also used when multiplying or dividing by a negative number.
-  Used in conjunction with  , the  is used to find the percentage of a given number. Used in conjunction with  , the  of a base number is added to that base in the display. Used with  , the  of a base number is discounted from that base in the display. When used in conjunction with  , the  function can be used for yield calculations.

-  Exchanges data in display with data saved in memory.
-  One press of key recalls data saved in memory to the display. Two presses of key clears data saved in memory.
-  Subtracts the display from data saved in memory. Repetitive subtractions of the display from data saved in memory can be done with this key.
-  Adds the display to data saved in memory. Repetitive addition of the display to data saved in memory can be done with this key.
-  The square root is generated to full seven digit floating point accuracy. Note that square root of a negative number is improper function and will be shown as an "Error". Single press of  restores display.
-  Used to terminate a calculation.
-  -  Number entry keys.
-  Enters decimal point.
-  Directs calculator to add display to following number. Repetitive pushes of  will increase display by multiples of base number.
-  Directs calculator to subtract following number from display. Repetitive pushes of

$\boxed{=}$  will decrease display by multiples of the base number.

$\boxed{\times}$  Directs calculator to multiply display by following number. Display may be raised to "N"th power by (N-1) repetitive pushes of  $\boxed{=}$  key.

$\boxed{\div}$  Directs calculator to divide display of following number. Dividing by "0" is improper and will be shown as an "Error".

### DISPLAY

**Error Signal**—When improper sequence of functions is entered into calculator, word "Error" will flash on display. A single press of  $\boxed{c/on}$  restores display.

**Memory Indicator**—A memory indicator light appears at the left side of display window when non-zero data is saved in memory.

**Minus Sign**—Appears to left of display to indicate negative number.

**Decimal Point**—Normal position for decimal in display of 6 or less integers is two positions from the right, however, calculator automatically positions decimal point to maintain full eight digit accuracy.

**Overflow Indication**—A square around the decimal point  $\boxed{\square}$  will appear in display when calculation has gone beyond capacity and refuse to permit further entries until  $\boxed{c/on}$  Key has been pushed.

**Battery Saving Display Flasher**—After approximately 50 seconds of non use, display will begin flashing on and off and continue to do this until approximately 15 minutes of non use have passed at which time it will automatically turn itself completely off. If the information in the display is needed sometime after the flashing sequence has begun, but before the machine is completely off, the display may be restored by pushing the Change Sign Key  $\boxed{+/-}$  twice.

## BATTERY HINTS

**BATTERY LIFE**—This calculator is designed to operate on 3 AA penlight batteries, which will provide up to 8 hours of continuous use. For the best cost/power ratio for your unit, use leak-proof Alkaline Batteries, which will improve operating life up to 16 hours of continuous use. When the display becomes erratic, dim or refuses to turn on, the batteries should be replaced.

**OPTIONAL A.C. ADAPTER OPERATION**—An optional A.C. Adapter/Battery Eliminator (Model #102 for 110 volt operation and Model #104 for 230 volt operation) is available that will allow this unit to be used with normal A.C. Power. When the adapter is used, the internal batteries are automatically disconnected to conserve battery life.

### OPTIONAL MODEL 2230R (RECHARGEABLE)

—This model comes with an internal battery pack that provides up to 6 hours of normal use. The batteries can be recharged in 12-14 hours with the enclosed A.C. Adapter/Charger (Model #103 for 110 volt operation and Model #105 for 230 volt operation).

The battery pack should be recharged when the calculator display becomes erratic, dim or calculator refuses to turn on. To obtain a maximum charge in a 12-14 hour time period, the calculator should be turned off during the charging, however, the calculator can be operated while the charger is connected. It is further recommended that if the machine has not been used for four or more weeks, it be recharged before using on battery power.

## OPERATION EXAMPLES

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### 1. Floating point display – underflow

<b>C/ON</b>	1	•	2345678	+	<b>1.2345678</b>
	10			+	<b>11.234567</b>
	100			+	<b>111.23456</b>
	1000			=	<b>1111.2345</b>

### 2. Clear entry

<b>C/ON</b>	1.2345678	×	<b>1.2345678</b>
	10	<b>C/ON</b>	<b>0.00</b>
	100	<b>C/ON</b>	<b>0.00</b>
	1000	=	<b>1234.5678</b>

### 3. Overflow

<b>C/ON</b>	1234567	×	<b>1234567.0</b>
	89	= (flashes)	<b>1 0987646</b>
	1	(cannot continue)	
		(clears overflow)	
		correct answer = $1.0987646 \times 10^8$	<b>1.0987646</b>
<b>C/ON</b>	÷	•	0001 =
			<b>10987.646</b>

### 4. Change sign

$14 \times (-2) = -28$

<b>C/ON</b>	14	×	2	+/-	=	<b>-28.00</b>
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### 5. Error signal

<b>C/ON</b>	99999	+/-	<b>√x</b>	<b>Error</b>
<b>C/ON</b>		+/-	<b>√x</b>	<b>316.22618</b>
<b>C/ON</b>	789	÷	0 =	<b>Error</b>

### 6. Power of number

$14^3 = 2744$

<b>C/ON</b>	14	×	=	=	<b>2744.00</b>
-------------	----	---	---	---	----------------

$6^5 = 7776$

<b>C/ON</b>	6	×	=	=	=	=	<b>7776.00</b>
-------------	---	---	---	---	---	---	----------------

### 7. Square root

$x = 179; \sqrt{x} = 13.379088$

<b>C/ON</b>	179	<b>√x</b>	<b>13.379088</b>
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### 8. Reciprocal

$x = 95; 1/x = .01052631$

<b>C/ON</b>	95	÷	=	=	<b>.01052631</b>
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### 9. Addition

$6.43 + 1.5 + 1700 = 1707.93$

<b>C/ON</b>	6	•	43	+	1	•	5	+	1700	=	<b>1707.93</b>
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## 10. Subtraction

$$17.051 - 1.0005 - 6 = 10.0505$$

$$\begin{array}{l} \text{C/ON } 17 \cdot 051 - 1 \cdot 0005 - \\ 6 = \end{array} \quad \boxed{10.0505}$$

## 11. Multiplication

$$65.11 \times .017 = 1.10687$$

$$\text{C/ON } 65 \cdot 11 \times \cdot 017 = \boxed{1.10687}$$

## 12. Division

$$14.387 \div 1.23 = 11.696747$$

$$\text{C/ON } 14 \cdot 387 \div 1 \cdot 23 = \boxed{11.696747}$$

## 13. Chain operation

$$16 + 7 \times 4.5 - 13 \div 7 = 12.928571$$

$$\begin{array}{l} \text{C/ON } 16 + 7 \times \quad \quad \quad \boxed{23.00} \\ 4 \cdot 5 - 13 \div \quad \quad \quad \boxed{90.50} \\ \quad \quad \quad 7 = \quad \quad \quad \boxed{12.928571} \end{array}$$

## 14. Automatic constant

$$\$13.96 + \$1.98 + \$1.98 = \$17.92$$

$$\begin{array}{l} \text{C/ON } 13 \cdot 96 + 1 \cdot 98 = \boxed{15.94} \\ = \quad \quad \quad \boxed{17.92} \end{array}$$

$$75 - 1.6673 = 73.3327; 5.44 - 1.6673 = 3.7727$$

$$\begin{array}{l} \text{C/ON } 75 - 1 \cdot 6673 = \boxed{73.3327} \\ 5 \cdot 44 \quad \quad \quad = \boxed{3.7727} \end{array}$$

$$18 \times 12 = 216 \quad .0643 \times 12 = .7716$$

$$\begin{array}{l} \text{C/ON } 18 \times 12 = \boxed{216.00} \\ \cdot 0643 = \boxed{0.7716} \end{array}$$

$$3.14 \div 50 = .0628 \quad 1712 \div 50 = 34.24$$

$$\begin{array}{l} \text{C/ON } 3 \cdot 14 \div 50 = \boxed{0.0628} \\ 1712 \quad \quad \quad = \boxed{34.24} \end{array}$$

## 15. Percent operation

$$\$1.75 + 6\% = 1.855$$

$$\begin{array}{l} \text{C/ON } 1 \cdot 75 + 6 \% \quad \quad \quad \boxed{0.105} \\ \quad \quad \quad \quad \quad \quad \quad = \quad \quad \quad \boxed{1.855} \end{array}$$

$$.79 - 13\% = .6873$$

$$\begin{array}{l} \text{C/ON } \cdot 79 - 13 \% \quad \quad \quad \boxed{0.1027} \\ \quad \quad \quad \quad \quad \quad \quad = \quad \quad \quad \boxed{0.6873} \end{array}$$

$$85 \times 4.5\% = 3.825$$

$$\text{C/ON } 85 \times 4 \cdot 5 \% \quad \quad \quad \boxed{3.825}$$

$$1.73 \div 21\% = 8.2380952$$

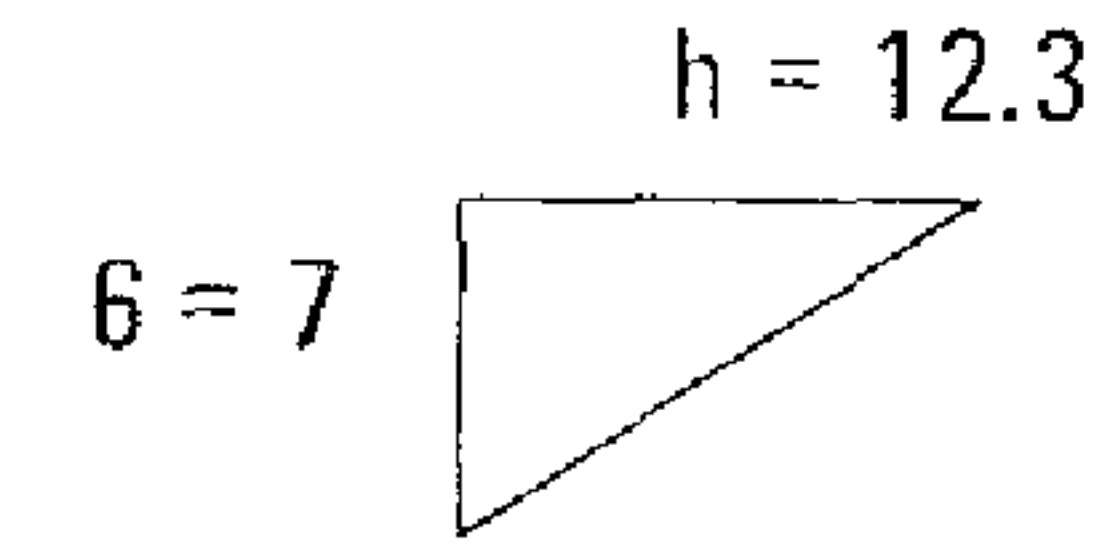
$$\text{C/ON } 1 \cdot 73 \div 21 \% \quad \quad \quad \boxed{8.2380952}$$

16. Memory operation

6 × 1.54 = 9.24  
 + 18 × .75 = 13.50  
 + 14 × 1.39 = 19.46  
 - 6 × .89 = 5.34  
 Gross 36.86  
 + Sales Tax 6% 2.21  
 Net 39.07

<b>C/ON</b>	6	<b>×</b>	1	<b>.</b>	54	<b>=</b>	<b>EX</b>	<b>.</b>	0.00
	18	<b>×</b>	<b>.</b>	75	<b>=</b>	<b>M+</b>	<b>.</b>	13.50	
						<b>EX</b>	<b>.</b>	22.74	
						<b>EX</b>	<b>.</b>	13.50	
	14	<b>×</b>	1	<b>.</b>	39	<b>=</b>	<b>M+</b>	<b>.</b>	19.46
	6	<b>×</b>	<b>.</b>	89	<b>=</b>	<b>M-</b>	<b>.</b>	5.34	
						<b>RM</b>	<b>.</b>	36.86	
<b>+</b>	6	<b>%</b>					<b>.</b>	2.2116	
					<b>=</b>		<b>.</b>	39.0716	

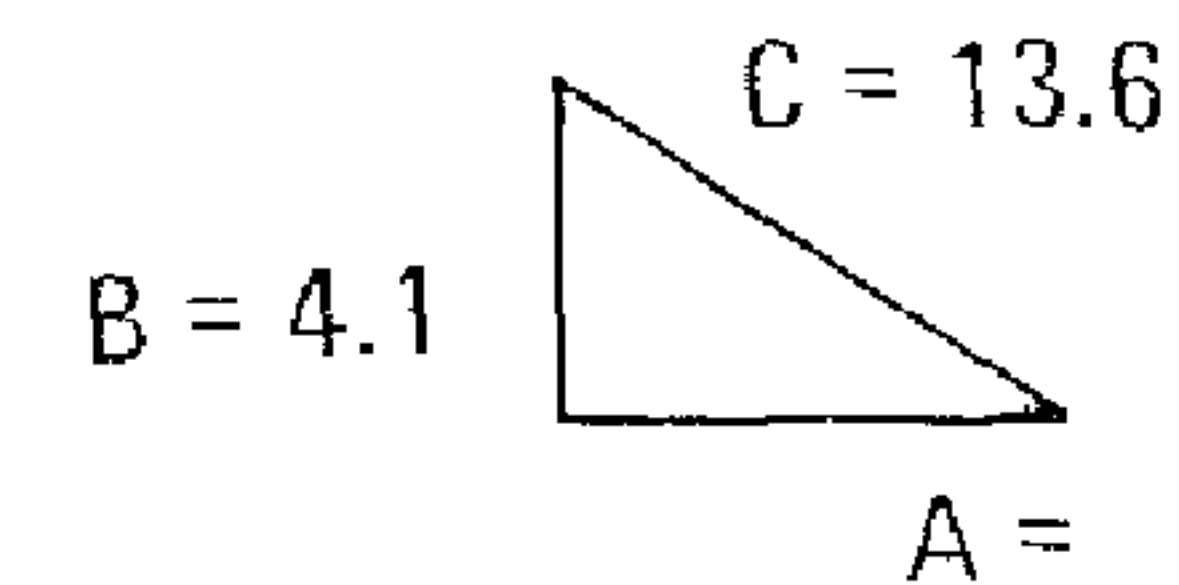
1. Area of triangle -  $A = \frac{bh}{2}$



$$A = \frac{7 \times 12.3}{2} = 43.05$$

<b>C/ON</b>	7	<b>×</b>	12	<b>.</b>	3	<b>÷</b>	<b>.</b>	86.10
					2	<b>=</b>	<b>.</b>	43.05

2. Side of right triangle -  $A = \sqrt{C^2 - B^2}$



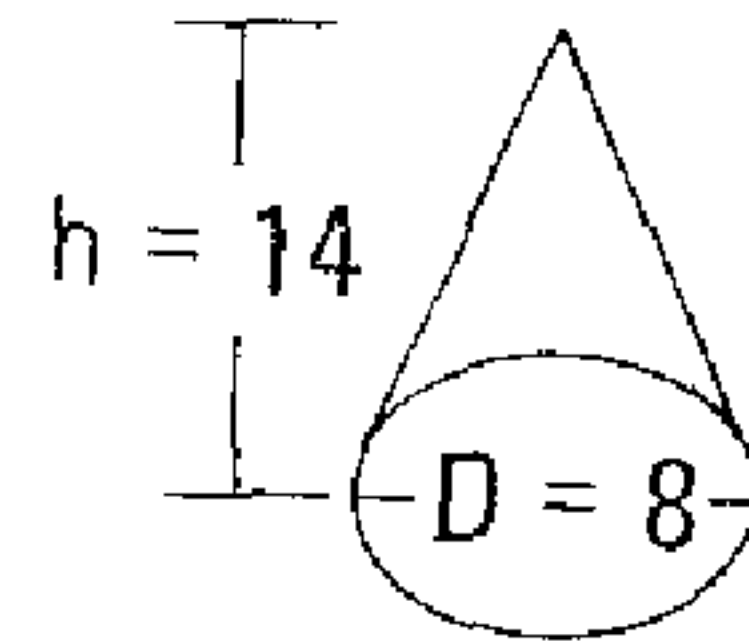
$$A = \sqrt{13.6^2 - 4.1^2} = 12.967266$$

<b>C/ON</b>	4	<b>.</b>	1	<b>×</b>	<b>=</b>	<b>EX</b>	<b>.</b>	0.00
	13	<b>.</b>	6	<b>×</b>	<b>-</b>	<b>.</b>	184.96	
					<b>RM</b>	<b>=</b>	<b>√x</b>	12.967266

3. Volume of cone -  $V = \frac{D^2 \pi h}{12}$

$$V = \frac{8^2 \times 3.14159 \times 14}{12}$$

$$= 234.57205$$



8 × = × 3 •

14159 ×

14 ÷ 12 =

201.06175

234.57205

4. Arithmetic progression

sum of first "N" numbers =  $\frac{N(N+1)}{2}$

N = 45;  $\frac{45(45+1)}{2}$

45 + 1 × 45 ÷

2 =

2070.00

1035.00

5. Geometric progression

sum of "N" terms =  $\frac{a(1-r^N)}{1-r}$ ; a = 1st term

r = common ratio

N = number of terms

a = 4, r = 3, N = 5  $S = \frac{4(1-3^5)}{1-3}$

1 - 3 = EX RM • -2.00

3 × = = = +/÷ • -243.00

+ 1 × 4 ÷ • -988.00

RM = • 484.00

6. Quadratic equation

$AX^2 + BX + C = 0; x = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$

A = 8; B = 28; C = -14.22

x = 0.45; -3.95

RM RM 28 × = M+ • 784.00

4 × 8 × 14 • 22 +/÷ = • -455.04

M- RM  $\sqrt{x}$   $\sqrt{B^2 - 4AC}$  = • 35.20

+ 28 +/÷ ÷ 16 = x = • 0.45

28 +/÷ - 35 • 2 ÷

16 = or x = • -3.95

7. Monthly amortization schedule for a \$3,000 loan--

simple monthly interest = 0.75%

monthly payments = \$200

number of months = 5



<b>C/ON</b>	3000	<b>EX</b>	<b>RM</b>	<b>◉</b>	3000.00
<b>X</b>	<b>◉</b>	75	<b>%</b>	Interest	<b>◉</b> 22.50
<b>M+</b>	200	<b>M-</b>	<b>RM</b>	<b>◉</b>	2822.50
			<b>%</b>	Interest	<b>◉</b> 21.16875
<b>M+</b>	200	<b>M-</b>	<b>RM</b>	<b>◉</b>	2643.6687
			<b>%</b>	Interest	<b>◉</b> 19.827515
<b>M+</b>	200	<b>M-</b>	<b>RM</b>	<b>◉</b>	2463.4962
			<b>%</b>	Interest	<b>◉</b> 18.476221
<b>M+</b>	200	<b>M-</b>	<b>RM</b>	<b>◉</b>	2281.9724
			<b>%</b>	Interest	<b>◉</b> 17.114793

8. Distance between points with rectangular coordination-

$(X_1, Y_1, Z_1)$  and  $(X_2, Y_2, Z_2)$

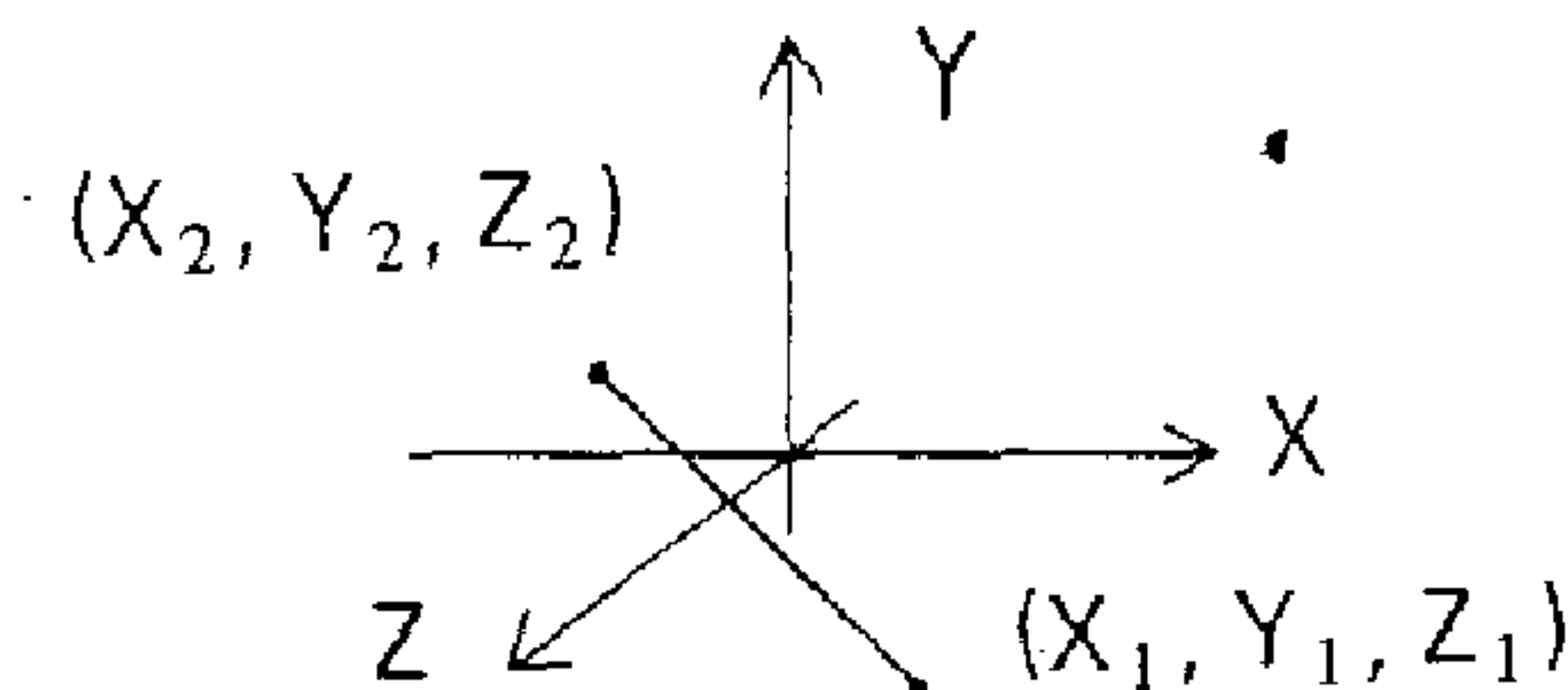
$$d = \sqrt{(X_2 - X_1)^2 + (Y_2 - Y_1)^2 + (Z_2 - Z_1)^2}$$

$X_1 = 3; Y_1 = -3.4; Z_1 = 8.4$

$X_2 = -2; Y_2 = 0.4; Z_2 = -1.04$

$$d = \sqrt{(-2 - 3)^2 + (0.4 - (-3.4))^2 + (-1.04 - 8.4)^2}$$

$$= 11.338147$$



<b>C/ON</b>	<b>RM</b>	<b>RM</b>	2	<b>+/-</b>	<b>-</b>	3	<b>X</b>	<b>=</b>	<b>M+</b>	<b>◉</b>	25.00
	<b>◉</b>	4	<b>-</b>	3	<b>◉</b>	4	<b>+/-</b>	<b>X</b>	<b>=</b>	<b>M+</b>	<b>◉</b> 14.44
1	<b>◉</b>	04	<b>+/-</b>	<b>-</b>	8	<b>◉</b>	4	<b>X</b>	<b>=</b>	<b>M+</b>	<b>◉</b> 89.1136
						<b>RM</b>	<b>√X</b>	<b>=</b>		<b>◉</b>	11.338147

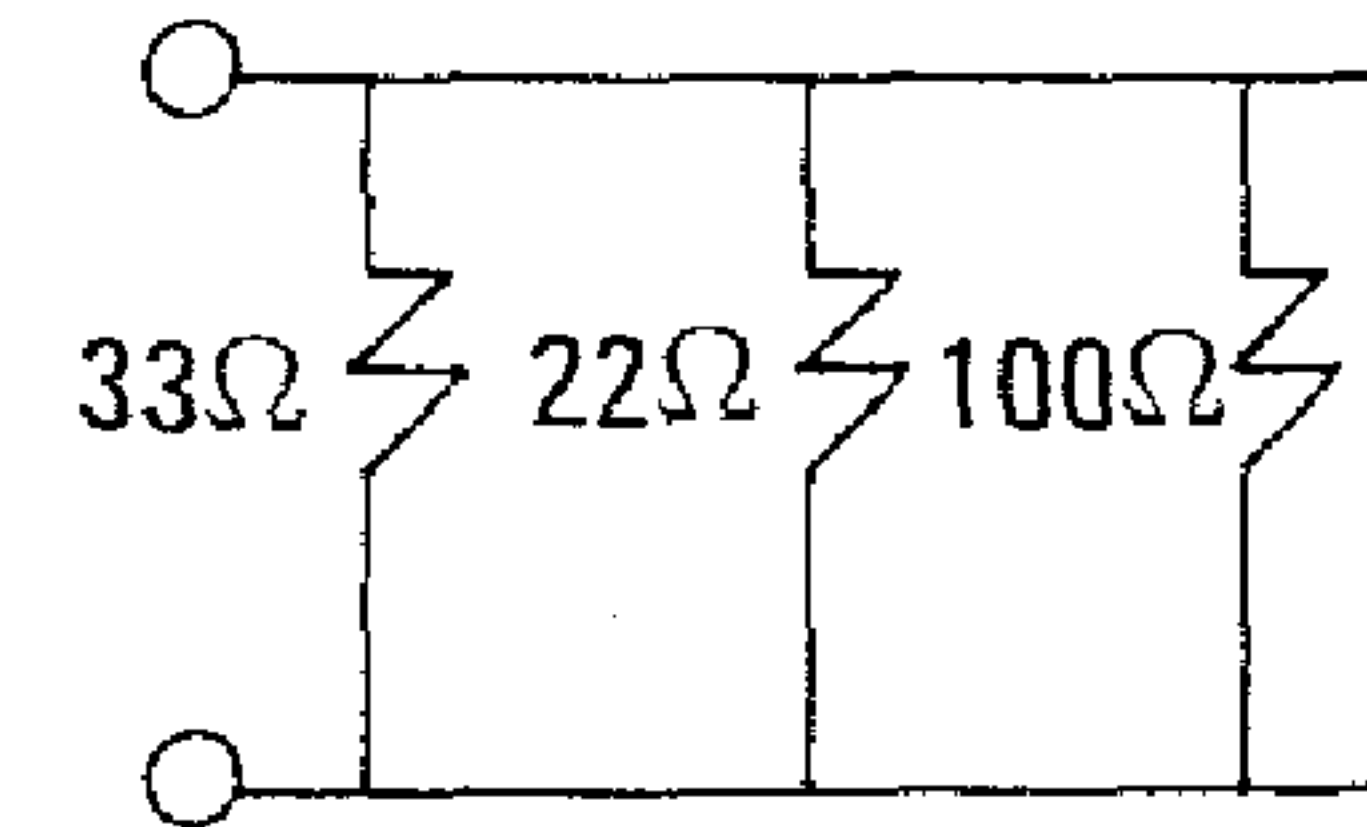
9. Parallel Resistors

Find the effective resistance of the three resistors in parallel: 33, 22, at 100 ohms.

$$R = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$$

$$= \frac{1}{\frac{1}{33} + \frac{1}{22} + \frac{1}{100}}$$

$$= 11.660778$$



<b>C/ON</b>	<b>RM</b>	<b>RM</b>	33	<b>÷</b>	<b>=</b>	<b>=</b>	<b>M+</b>	<b>◉</b>	03030303
22	<b>÷</b>	<b>=</b>	<b>=</b>	<b>M+</b>	<b>◉</b>	04545454			
100	<b>÷</b>	<b>=</b>	<b>=</b>	<b>M+</b>	<b>◉</b>	01			
	<b>RM</b>	<b>÷</b>	<b>=</b>	<b>=</b>	<b>◉</b>	11.660778			

10. Mean, variance and standard deviation –  
Find the mean, variance and standard deviation  
for the values 2, 3, 6, 9, 3

$$\begin{aligned} \text{Mean : } \bar{X} &= \frac{1}{n} \cdot \sum_{i=1}^n X_i = \frac{\sum X}{n} \\ &= (2 + 3 + 6 + 9 + 3)/5 \\ &= 4.6 \end{aligned}$$

<b>C/ON</b>	2	+	3	+	6	+	9	=	9
		+	3	÷	5	=			4.60

$$\begin{aligned} \text{Variance : } \sigma^2 &= \frac{\sum X^2 - n\bar{X}^2}{n - 1} \\ &= \frac{2^2 + 3^2 + 6^2 + 9^2 + 3^2 - 5(4.6)^2}{4} \\ &= 8.3 \end{aligned}$$

<b>C/ON</b>	2	×	=	EX	3	×	=	M+	9.00	
	6	×	=	M+	9	×	=	M+	81.00	
	3	×	=	M+	4	•	6	×	=	21.16
		×	5	+/-	+	RM	÷			33.20
			4				=			8.30

Standard deviation :  $\sigma$   
 $\sigma^2 = 8.30$   
 $\sigma = 2.880972$

<b>C/ON</b>	8	•	3	√X	=	2.880972
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**FULL ONE YEAR WARRANTY  
and UNCONDITIONAL GUARANTY**

Litronix, Inc. warrants your Litronix calculator in accordance with Federal minimum standards for Full Warranty for one year from the date of retail purchase by the original owner. In addition, Litronix unconditionally guarantees that your Litronix calculator will function properly for one year from the date of such retail purchase. Should your Litronix calculator cease functioning properly at any time within such one year period because of a defect, malfunction or any other cause, Litronix, without charge, will promptly repair the calculator or replace it with a new one. **CONSEQUENTIAL DAMAGES FOR BREACH OF WARRANTY OR UNCONDITIONAL GUARANTY ARE EXCLUDED.** No action for breach of warranty or unconditional guaranty may be commenced more than one year after the cause of action has accrued.

**BEFORE RETURNING YOUR LITRONIX CALCULATOR FOR REPAIR, PLEASE CHECK THE BATTERIES.** If, after checking the batteries, your Litronix calculator still requires repair, send it to Litronix, Inc., P.O. Box 6000, Cupertino, California 95014, Attention: Quality Assurance Department.

Litronix undertakes these obligations in good faith and with full confidence in the workmanship and quality of Litronix products.

**LITRONIX 2230 GUARANTEE REGISTRATION** TO REGISTER YOUR CALCULATOR UPON PURCHASE,  
 COMPLETE AND MAIL TO: LITRONIX, INC., 19000 HOMESTEAD ROAD, CUPERTINO, CALIFORNIA 95014

MR.  SERIAL # \_\_\_\_\_  
 NAME MRS.  DATE OF PURCHASE \_\_\_\_\_  
 MISS

ADDRESS \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

YOUR APPROX. AGE:  WHERE WILL MACHINE BE PRIMARILY USED?  
 UNDER 18  AT HOME  BOUGHT FOR SELF   
 18-24  AT SCHOOL  BOUGHT FOR GIFT   
 25-34  AT WORK   
 35-49  OTHER \_\_\_\_\_ AMOUNT PAID FOR  
 50 & OVER  CALCULATOR (NOT  
 INCLUDING TAX) \$ \_\_\_\_\_

YOUR OCCUPATION:  INCLUDING THIS NEW LITRONIX,  
 STUDENT  HOW MANY PERSONAL CALCULATORS  
 EDUCATOR/TEACHER  ARE OWNED BY YOUR IMMEDIATE  
 DOCTOR/LAWYER  HOUSEHOLD?  
 ENGINEER/SCIENTIST  ONE   
 SALESMAN  TWO   
 ACCOUNTANT  THREE OR MORE   
 OTHER \_\_\_\_\_

TYPE OF STORE PURCHASED FROM:  
 DEPARTMENT STORE   
 DISCOUNT STORE   
 OFFICE SUPPLY STORE   
 BOOK STORE   
 MAIL ORDER

OTHER \_\_\_\_\_