

# SIMPLE TRS-80 PROGRAMS SOLVE ELECTRONICS CALCULATIONS

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**T**HE FOLLOWING programs were designed to be run on a Level-1 TRS-80 microcomputer having 4K of memory. All the programs are self-prompting when run and are also readily adaptable to any other BASIC. (The square-root subroutine can be eliminated if your particular BASIC has a built-in square-root function.)

**Ohm's Law.** This program, shown in Table 1, is fairly short and has no subroutines. Line 40 selects the unknown resistance, voltage, current or power. Lines 70 through 100 are used to deter-

mine the unknown resistance; lines 110 through 130 are for current, while lines 145 through 160 are used to determine the voltage. Once the current (I) and resistance (R) have been determined, line 295 displays the wattage.

**Resonance.** The program shown in Table 2 can determine frequency of a tuned circuit when C and L are known, or can determine either C or L if the desired resonant frequency and one of these two elements are known. The program will also determine the Q of a series or parallel tuned circuit, bandwidth

and/or the impedance. The square-root subroutine used in determining resonant frequency is called at line 220.

**Inductive Formulas.** Table 3 illustrates a program that will determine instantaneous voltage, inductance of a single-layer coil, inductive/resistive time constant, the values of series and/or parallel inductors, the Q of a coil, inductive reactance and impedance of an inductive/resistive circuit. The only subroutine used (square root) is called at line 720, with this subroutine residing at line 30000.

**Table 1—Ohm's Law**

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15  CLS
20  P.T.(20);"OHM'S LAW FORMULAS"
30  P."SELECT NUMBER FOR DESIRED FUNCTION"
40  IN."RESISTANCE=R, CURRENT=C, VOLTAGE=V,
    POWER=P";A
60  IF A=R,G.70
62  IF A=C,G.110
65  IF A=V,G.145
67  IF A=P,G.180
70  IN."ENTER VOLTAGE IN VOLTS";E
80  IN."ENTER CURRENT IN AMPERES";I
100 P."THE RESISTANCE EQUALS";E/I;" OHMS"
105  END
110 IN."ENTER VOLTAGE IN VOLTS";E
120 IN."ENTER RESISTANCE IN OHMS";R
130 P."THE CURRENT IS EQUAL TO";E/R;" AMPERES"
140  END
145 IN."ENTER CURRENT IN AMPERES";I
150 IN."ENTER RESISTANCE IN OHMS";R
160 P."THE VOLTAGE IS ";I*R;" VOLTS WITH ";R;" OHMS
    AND ";I;" AMPERES"
170  END
180 IN."ENTER MISSING VARIABLE R,I,E";B
190 IF B=R,G.210
195 IF B=I,G.240
200 IF B=E,G.270
210 IN."ENTER CURRENT (I)";I
220 IN."ENTER VOLTAGE (E)";E
230 P=I*E
235 G.295
240 IN."ENTER VOLTAGE (E)";E
250 IN."ENTER RESISTANCE (R)";R
260 P=(E*E)/R
265 G.295
270 IN."ENTER CURRENT (I)";I
280 IN."ENTER RESISTANCE (R)";R
290 P=(I*I)*R
295 P."THE POWER IS ";P;" WATTS"
300  END
    
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**Table 2—Resonance (Tuned Circuits)**

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5  CLS
10  P.T.(15);"VARIOUS FORMULAS
    ON RESONANT FREQUENCY"
20  P."ENTER NUMBER OF DESIRED FUNCTION";
30  P."RESONANT FREQUENCY (FO)          #1"
40  P."UNKNOWN INDUCTANCE (L)           #2"
50  P."UNKNOWN CAPACITOR (C)            #3"
60  P."Q OF SERIES OR PARALLEL CIRCUIT (Q) #4"
70  P."BANDWIDTH (BW)                    #5"
80  P."IMPEDANCE, SERIES OR PARALLEL (Z) #6"
90  IN."UNKNOWN FACTOR IS NUMBER ";U
100 IF U=1,G.170
110 IF U=2,G.240
120 IF U=3,G.280
130 IF U=4,G.320
140 IF U=5,G.360
150 IF U=6,G.520
170 IN."ENTER VALUE OF INDUCTOR IN MILLIHENRIES";L
180 IN."ENTER VALUE OF CAPACITOR IN MICROFARADS";C
210 X=(L/1E3)*(C/1E8)
220 GOS.30030
230 P."THE RESONANT FREQUENCY IS ";159/Y;" HERTZ"
235  END
240 IN."ENTER RESONANT FREQUENCY (FO) DESIRED";F
250 IN."ENTER CAPACITOR VALUE IN MICROFARADS";C
260 L=.0254/(F*F)*(C/1E6)
270 P."THE INDUCTOR NEEDED IS ";L*1000;" MILLIHENRIES"
275  END
280 IN."ENTER RESONANT FREQUENCY DESIRED ";F
290 IN."ENTER INDUCTOR VALUE IN MILLIHENRIES ";L
300 C=.0254/(F*F)*(L/1E3)
310 P."THE CAPACITOR NEEDED IS ";C*1E6;" MICROFARADS"
315  END
320 IN."ENTER THE REACTANCE (XC OR XL) IN OHMS";X
330 IN."ENTER THE SERIES RESISTANCE IN OHMS";R
340 P."THE Q OF THE CIRCUIT IS ";X/R;" UNITS"
350  END
360 IN."ENTER UNKNOWN, O=Q, FO=F, BW=B";X
370 IF X=Q,G.400
    
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380 IF X=F,G.440
390 IF X=B,G.480
400 IN."ENTER FO IN HERTZ";F
410 IN."ENTER BW (F2-F1) IN HERTZ";B
420 P."THE Q IS EQUAL TO ";F/B;" UNITS"
430 END
440 IN."ENTER THE Q OF THE CIRCUIT";Q
450 IN."ENTER THE BW (F2-F1) IN HERTZ";B
460 P."THE RESONANT FREQUENCY (FO)
IS ";Q*B;" HERTZ"
470 END
480 IN."ENTER RESONANT FREQUENCY (FO) IN HERTZ";F
490 IN."ENTER THE Q VALUE";Q
500 P."THE BANDWIDTH IS ";F/Q;" HERTZ"
510 END
520 IN."ENTER VALUE OF INDUCTOR IN MILLIHENRIES";L
530 IN."ENTER FREQUENCY IN HERTZ";F
535 IN."ENTER RESISTOR VALUE IN OHMS";R
540 P."AT SERIES RESONANCE, XL AND XC CANCEL
THEREFORE Z=";R
550 P="(6.28)*(F)*(L/1E3)
560 Q=P/R
570 P."THE PARALLEL IMPEDANCE IS EQUAL
TO ";P*Q;" OHMS"
580 END
30000 END
30010 REM *SQUARE ROOT* INPUT X, OUTPUT Y
30020 REM ALSO USES W & Z INTERNALLY
30030 IF X=O T, Y=O:RET.
30040 IF X > O T, 30060
30050 P."ROOT OF NEGATIVE NUMBER?":STOP
30060 Y=X*.5:Z=O
30070 W=(X/Y-Y)*.5
30080 IF (W=O) + (W=Z) T, RET.
30090 Y=Y+W: Z=W:G.30070

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**Table 3—Inductive Formulas**

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2 CLS
10 P."AFTER EACH SOLUTION, PRESS R, ENTER
TO BEGIN."
15 P.T.(15)"VARIOUS INDUCTIVE FORMULAS"
20 P."ENTER THE NUMBER NEXT TO DESIRED
FUNCTION"
30 P."INSTANTANEOUS VOLTAGE #1"
40 P."INDUCTANCE OF A SINGLE LAYER COIL #2"
50 P."INDUCTIVE/RESISTIVE TIME CONSTANT #3"
60 P."SERIES AND PARALLEL INDUCTORS #4"
70 P."Q OF A COIL #5"
80 P."INDUCTIVE REACTANCE (XL) #6"
90 P."IMPEDANCE OF INDUCTIVE/RESISTIVE CIRCUIT #7"
100 IN."FORMULA DESIRED";F
110 IF F=1 G.160
120 IF F=2 G.220
130 IF F=3 G.280
140 IF F=4 G.320
144 IF F=5 G.570
145 IF F=6 G.640
146 IF F=7 G.690
160 IN."ENTER VALUE OF INDUCTANCE IN HENRIES";L
170 IN."ENTER CHANGE IN CURRENT (I2-I1) IN AMPS";I
180 IN."ENTER CHANGE IN TIME (T2-T1) IN SECONDS";T
190 E=L*(I/T)
200 P."THE VOLTAGE DEVELOPED IS";E;"VOLTS"
210 END
220 IN."ENTER NUMBER OF TURNS";N
230 IN."ENTER RADIUS OF COIL IN INCHES";R
240 IN."ENTER LENGTH OF COIL IN INCHES";D
250 L=(N*R)*(N*R)/(9*R)+(10*D)
260 P."THE INDUCTANCE IS";L;"MICROHENRIES"

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270 END
280 IN."ENTER THE VALUE OF INDUCTANCE
IN HENRIES";L
290 IN."ENTER THE VALUE OF RESISTANCE
IN OHMS";R
300 T=L/R
310 P."THE TIME CONSTANT IS";T;"SECONDS"
315 END
320 IN."ENTER THE NUMBER OF INDUCTORS";B
330 IF B=2 G.360
340 IF B=3 G.420
350 IF B=4 G.490
360 IN."ENTER VALUE OF L1 IN HENRIES";A
370 IN."ENTER VALUE OF L2 IN HENRIES";B
380 C=A+B
390 P."THE TOTAL SERIES INDUCTANCE IS";C;"HENRIES"
400 D=(1/A)+(1/B)
405 P."THE TOTAL PARALLEL INDUCTANCE
IS";1/D;"HENRIES"
410 END
420 IN."ENTER VALUE OF L1 IN HENRIES";A
430 IN."ENTER VALUE OF L2 IN HENRIES";B
440 IN."ENTER VALUE OF L3 IN HENRIES";C
450 D=(1/A)+(1/B)+(1/C)
460 P."THE TOTAL INDUCTANCE IN SERIES
IS";A+B+C;"HENRIES"
470 P."THE TOTAL INDUCTANCE IN PARALLEL
IS";1/D;"HENRIES"
480 END
490 IN."ENTER VALUE OF L1 IN HENRIES";A
500 IN."ENTER VALUE OF L2 IN HENRIES";B
510 IN."ENTER VALUE OF L3 IN HENRIES";C
520 IN."ENTER VALUE OF L4 IN HENRIES";D
530 E=(1/A)+(1/B)+(1/C)+(1/D)
550 P."THE TOTAL PARALLEL INDUCTANCE
IS";1/E;"HENRIES"
540 P."THE TOTAL SERIES INDUCTANCE
IS";A+B+C+D;"HENRIES"
555 END
570 IN."ENTER INDUCTOR VALUE IN HENRIES";L
580 IN."ENTER THE FREQUENCY IN HERTZ";H
590 IN."ENTER RESISTOR VALUE IN OHMS";R
600 X=6.28*H*L
610 Q=X/R
620 P."THE REACTANCE OF THE CIRCUIT
IS";X;"OHMS WITH A Q OF";Q
630 END
640 IN."ENTER THE VALUE OF INDUCTOR IN
MILLIHENRIES";L
650 IN."ENTER THE FREQUENCY IN HERTZ";H
660 X=(6.28)*(H)*(L/1000)
670 P."THE REACTANCE OF THE CIRCUIT IS";X;"OHMS"
680 END
690 IN."ENTER THE VALUE OF INDUCTIVE REACTANCE
IN OHMS";P
700 IN."ENTER THE VALUE OF RESISTANCE
IN OHMS";R
710 X=(P*P)+(R*R)
720 GOS 30030
730 P."THE IMPEDANCE OF THE CIRCUIT IS";Y;"OHMS"
740 END
30000 END
30010 REM *SQUARE ROOT* INPUT X, OUTPUT Y
30020 REM ALSO USES W AND Z INTERNALLY
30030 IF X=O T, Y=O:RET.
30040 IF X > O T, 30060
30050 P."ROOT OF A NEGATIVE NUMBER?":STOP
30060 Y=X*.5:Z=O
30070 W=(X/Y-Y)*.5
30080 IF (W=O)+(W=Z) T, RET.
30090 Y=Y+W:Z=W:G.30070

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