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The metric system

METRIC UNITS

In New Zealand we are using S.I. (Système International d'Unités) metric units. Only a small proportion of the total S.I. units will be needed for everyday use. These are:

Quantity	Unit	Symbol
LENGTH	millimetre	mm
	centimetre	cm
	metre	m
	kilometre	km
AREA	square centimetre	cm ²
	square metre	m ²
	hectare	ha
VOLUME	cubic centimetre	cm ³
	cubic metre	m ³
CAPACITY	millilitre	ml
	litre	ℓ or litre
MASS (weight)	gram	g
	kilogram	kg
	tonne	t
LAND SPEED	kilometres per hour	km/h
FORCE	newton	N
PRESSURE	kilopascal	kPa
TEMPERATURE	degrees Celsius	°C

THE PREFIXES OF SI UNITS

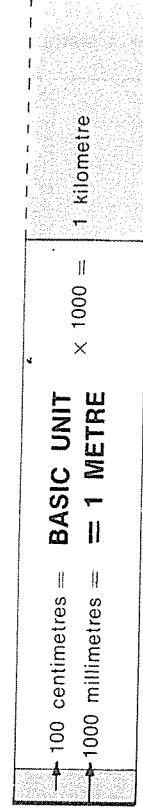
There is a unit common to each quantity—for example, the unit in length is the metre. The prefixes “milli”, “centi”, and “kilo” denote how many parts of the basic unit or how many times the basic unit a measurement is. For example, a centimetre is one-hundredth of a metre, and a kilometre is one thousand times a metre. All metric units in each quantity are related to each other in multiples of 10.

The most common prefixes are:

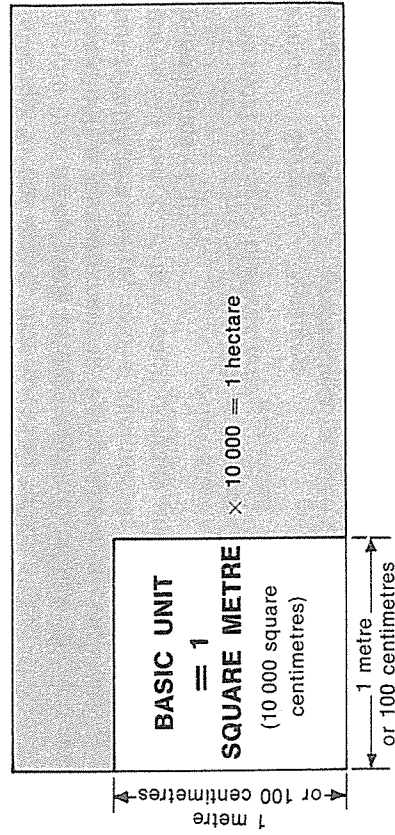
Prefix	Symbol	Meaning
mega	M	one million times
kilo	k	one thousand times
hecto	h	one hundred times
deca	da	ten times
deci	d	one-tenth
centi	c	one-hundredth
milli	m	one-thousandth
micro	μ	one-millionth

The following diagrams illustrate the common measurements of length, area, volume, and mass (weight).

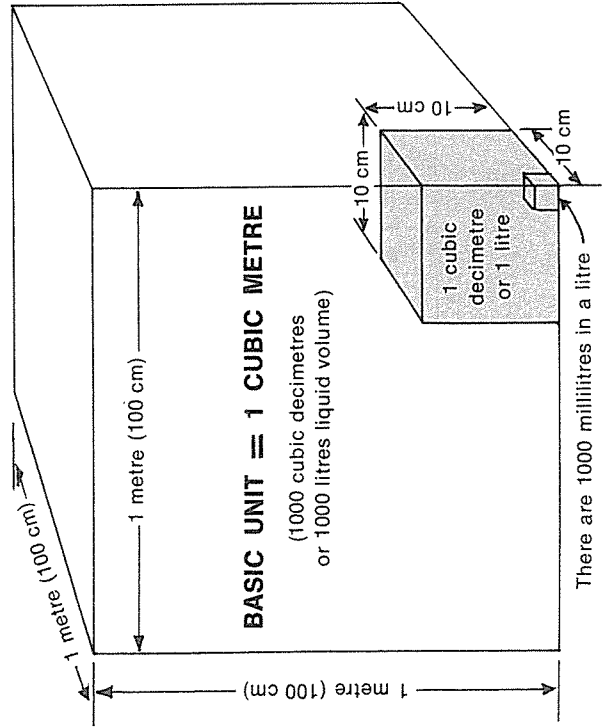
LENGTH



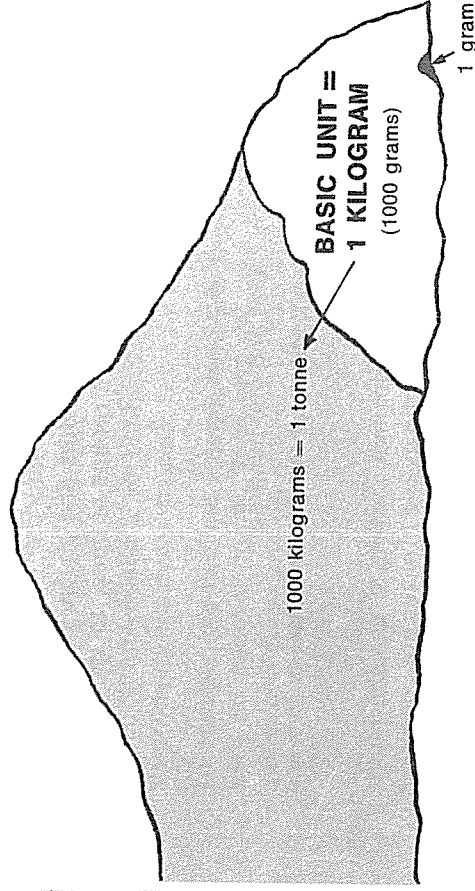
AREA



VOLUME



MASS (weight)



SPECIAL NAMES

Although the basic unit and the metric prefix are used for most measures, some special names are given to commonly used quantities. For example:

1000 kilograms are called 1 tonne.

A cubic decimetre is called a litre when liquid capacity is measured. One-thousandth of this volume is called either a cubic centimetre (cm³) or, when liquid capacity is measured, a millilitre (ml).

In area, 10 000 square metres are called a hectare.

Pascal is the name given to a pressure of 1 newton per square metre.

Note: There is a correct way of writing metric units and symbols. This is followed throughout this book. For more information on style see Metric Advisory Board Memo No. 3.



The decimal system

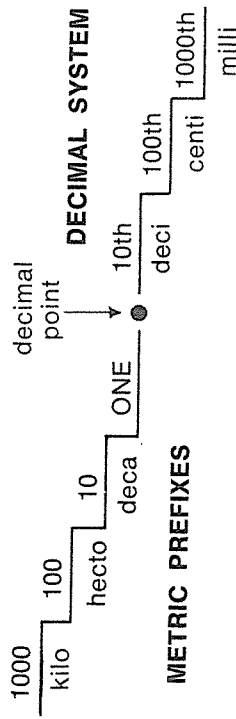
The decimal system uses the decimal point to separate whole numbers from parts of the whole. The figures to the left of the point are ones, tens, hundreds, and thousands—we are already familiar with these. To the right of the point are tenths, hundredths, thousandths, ten thousandths and so on. (In the metric system numbers are arranged in groups of three, to the left and right of the decimal point, separated by a space—for example, 10 569.532 15.)

21.5 means twenty-one and five-tenths

100.01 means one hundred and one-hundredth

5.25 means five and two-tenths and five-hundredths—or five and twenty-five hundredths

You need to understand the decimal system to use the metric system. The decimal system and the metric prefixes are compared in this diagram:



Therefore: 0.03 metres = 3 centimetres or 30 millimetres.

OR 30.0 millimetres = 3 centimetres or 0.03 metres.

2.34 metres means 2 metres and 34 centimetres, or 234 centimetres. (Metric figures are never written with a mixture of units; you would never say 2 metres 34 centimetres, but would say either 2.34 m or 234 cm.)

Multiplying or dividing by tens or hundreds is simply a matter of moving the decimal point to increase or decrease the value.

To multiply by 10 move the point one space to the right:

$$15.2 \times 10 = 152.0$$

To divide by 10 move the point one space to the left:

$$15.2 \div 10 = 1.52$$

To multiply by 100 move the point two spaces to the right.

To divide by 100 move the point two spaces to the left.

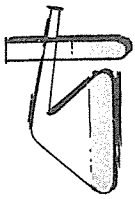
To multiply two decimal figures, simply multiply as though there were no decimal points. Then add the total number of decimal places and make sure the answer has the same number.

$$\begin{array}{r}
 2.42 \\
 \times 5.1 \\
 \hline
 242 \\
 12100 \\
 \hline
 12342 \\
 = 12.342
 \end{array}$$

3 decimal places

To divide decimal figures, move the point to the right in the figure you are dividing by to make it a whole number. Then move the point in the figure to be divided the same number of places to the right. In other words you are multiplying both numbers by the same multiple of 10.

$$\begin{array}{r}
 2.43 \overline{) 786.40} \\
 \underline{486} \\
 300 \\
 \underline{306} \\
 40 \\
 \underline{40} \\
 0
 \end{array}$$



Agricultural chemicals

When agricultural chemical labels are in metric figures active ingredient statements will be given as:

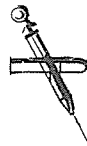
Solids: grams per kilogram (g/kg)

Liquids: grams per litre (g/litre)

You will need to calculate

in metric terms

Area of land	hectares (ha)	see p. 27-29
Speed	kilometres per hour (km/h)	" 42 & 35
Pressure of sprays	kilopascals (kPa)	" 40-41
Volume of spray tank	litres (ℓ)	" 43-45
Weight of ingredients	grams (g) and kilograms (kg)	" 36-37
Concentration of sprays	grams per 100 litres (g/100 litres)	" 30-31
Spraying rates	litres per hectare (litres/ha)	" 45-46
	millilitres per hectare (ml/ha)	" 45-46



Animal remedies

The majority of animal remedies have been sold in metric measures for some time, and most equipment—such as drenching guns—is now graduated in the same way. If equipment is not graduated in metric measures you will need to recalibrate it or buy new, correctly calibrated equipment.

Note: If equipment is graduated in cc recalibration will not be necessary, as 1 cc (now written cm³) = 1 ml.

You will need to calculate

in metric terms

Volume of doses	millilitres (ml)	see p. 43-45
Volume of plunge and shower dips	litres (ℓ)	" 43-45
Weight of ingredients and livestock	grams (g) and kilograms (kg)	" 36-37
Pressure	kilopascals (kPa)	" 36-37
Concentration of dips and drenches	grams per litre (g/litre)*	" 40-41
		" 30-31

If in any doubt about what to do, consult your veterinarian.

* The tables showing grams/100 litres can be used.



Beef

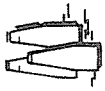
Beef grades will be given in kilograms. (At the time of going to press the new metric beef grades were not available.)

To convert the number of cattle beasts per acre to per hectare, multiply the number by 2.47 (or, for rough conversion, by 2.5).

You will need to calculate

in metric terms

Livestock weights	kilograms (kg)	see p. 36-37
Cost	cost per kilogram	" 49



Dairying

Dairy companies will measure milk by the litre (volume) and farm-separated cream by the kilogram (weight). Payment for milk and cream will be on kilograms of milkfat. Milkfat will be shown on advice notes as kilograms per litre (kg/litre) for milk and kilograms per kilogram (kg/kg) for cream. Percentages will also be used, especially when you are speaking. They will be given as % w/v (percent weight by volume) for milk and % w/w (percent weight by weight) for cream.

4.5% w/v = 0.045 kg/litre 4.5% w/w = 0.045 kg/kg

For town milk supply, milk will be purchased by the litre.

Temperature for primary cooling of milk 18.5 °C

Temperature of refrigerated milk 7 ° to 13 °C

Volume of water needed per set of cups (excluding other equipment) 10 litres

Minimum distance of dairy from public road 45 m

Minimum clearance of roof above vat 1 m

Normal milking vacuum 500 kPa

You will need

to calculate

in metric terms

Length (for fencing) metres (m) see p.33-35

Volume for milk litres (ℓ) " 43-45

Weight for milkfat kilograms (kg) " 36-37

Pressure (vacuum) kilopascals (kPa) " 40-41

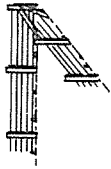
Power (motors) kilowatts (kW) " 32

Milk volume (metric) from

milk weight (imperial) lb milk to litres (ℓ) " 48

Costs costs per kilogram " 49

Yields kilograms per hectare (kg/ha) " 38-39



Fencing

The metric equivalents of some boundary fence measurements are:

	<i>Imperial</i>	<i>Metric Equivalent</i>
Distance between posts	16 feet 6 inches	5.03 metres

Height of bottom wire from ground level	5 inches	127 millimetres
---	----------	-----------------

Height of top wire above ground level	3 feet 9 inches	1.143 metres
---------------------------------------	-----------------	--------------

Fencing costs, instead of being calculated per mile, will be calculated per kilometre. Here are some average costs.

	Costs Per Mile		Costs Per Kilometre*	
	materials	labour	materials	labour
seven-wire standard	\$1000	\$600	\$620	\$375
eight-wire steel	\$500	\$500	\$310	\$310
Pearse fence	\$450	\$250	\$280	\$155
Live fencing	\$200	\$320	\$125	\$200
		\$520		\$325

* Rounded to nearest \$5

You will need

to calculate

in metric terms

Length millimetres (mm) see p. 33

metres (m) " 33-35

kilometres (km) " 33-35



Fertilisers

Fertilisers will be sold ex works in 50 kilogram bags or by the tonne. Recommendations for application will be in kilograms per hectare (kg/ha).

You will need to calculate

in metric terms

Areas of paddocks	hectares (ha)	see p. 27-29
Speed	kilometres per hour (km/h)	" 42
Weights of fertiliser	kilograms or tonnes (kg or t)	" 36-37
Application rates*	kilograms per hectare (kg/ha)	" 38-39
Costs	cost per kilogram	" 49
	or cost per hectare	" 49

* Accurate conversion of hundredweights per acre to kilograms per hectare gives awkward figures. Recommendations will be rounded off to give practical quantities as shown in the following table.

cwt/acre	kg/ha	kg/acre
1	125	50
2	250	100
3	375	150
4	500	200
5	625	250
6	750	300
7	875	350
8	1000	400
9	1125	450
10	1250	500

Note: 1000 kilograms = 1 tonne.



Forestry

Breast height will be 1.4 metres from ground level (on the uphill side of a tree on sloping ground).

Log measurement: Length will be in metres to the nearest 0.1 metre below; diameter will be in centimetres to the nearest whole even number (for example, 19.1 cm to 21.0 cm inclusive will be recorded as 20 cm). Girth is no longer used as a log measurement.

You will need to calculate

in metric terms

Length for tree height and diameter, and log measurement	metres (m) centimetres (cm)	see p. 33-35 " 33-35
Area of land	hectares (ha)	" 27-29
Area for sectional area of trees and stands	Square metres (m ²)	" 27-29
Volume of trees and logs	Cubic metres (m ³)	" 43-45

To convert the number of trees per acre to per hectare, multiply the number by 2.47 (or, for rough conversion, by 2.5).



Grains and seeds

Grains, seeds, and produce will be measured in kilograms and tonnes. The bushel will no longer be used. Where weight for a given volume is required to measure quality, kilograms per hectolitre will be used instead of pounds per bushel. The conversion factor is: pounds per bushel \times 1.2472 = kilograms per hectolitre.

Grain merchants will sell seeds and peas in the following metric packs:

	Gross Weight
Clovers, ryegrasses, browntop, dogstail, timothy, fescue, brassicas, and lucerne	50 kg
Cocksfoot, prairie grass	35 kg
Field peas	75 kg
Garden peas	50 kg
Machine-dressed seed wheat, machine-dressed seed lupins, tares, and ryecorn	75 kg
Machine-dressed seed barley	70 kg
Machine-dressed seed oats	60 kg
Machine-dressed seed beans	50 kg

Sack sizes will be measured in millimetres (mm), but the actual sizes remain unchanged.

CALIBRATION OF SEED DRILLS

Conversion kits will be available for most recent-model drills; your agents will advise you on what is available. Older drills could probably be converted by an engineer.

You will need to calculate

	<i>in metric terms</i>	
Length (row width, plant spacing)	centimetres (cm) and metres (m)	see p.33-35 " 33-35
Area of paddocks	hectares (ha)	" 27-29
Volume of bulk stores	cubic metres (m ³)	" 43-45
Weights of yields	kilograms (kg) and tonnes (t)	" 36-37
Speed of tractors	kilometres per hour (km/h)	" 42 & 35
Sowing rates	kilograms per hectare (kg/ha)	" 38-39
Crop yields	kilograms or tonnes per hectare (kg or t/ha)	" 38-39 " 38-39



Horticulture

Metrication in horticulture will be similar in many ways to metrication in the grains and seeds industry (see page 20). Fruit and vegetable sizing will be in millimetres (mm).

You will need to calculate

	<i>in metric terms</i>	
Areas of plots	square metres (m ²)	see p.27-29
Length (for produce sizing and plant spacing)	millimetres (mm) centimetres (cm) metres (m)	" 33-35 " 33-35 " 33-35
Temperatures	degrees Celsius (°C)	" 42

To convert the number of trees or plants per acre to per hectare, multiply the number by 2.47 (or, for rough conversion, by 2.5).



Poultry

Egg grading, under the metric system, is:

NZEMA grading	Egg weight grams	Min. weight per dozen eggs, grams
7	62+	744
6	53 to 62	636
5	44 to 53	528
4	35 to 44	420

Energy values of feeds will be measured in kilojoules per kilogram (kJ/kg). For quick conversions:

$$\text{Cal/lb} \times 9.2 = \text{kJ/kg (0.3 percent error)}$$

You will need to calculate

	<i>in metric terms</i>	
Length (for fencing and housing)	millimetres (mm)	see p. 33-35
	centimetres (cm)	" 33-35
	metres (m)	" 33-35
Area of housing	square metres (m ²)	" 27-29
Weights (for feed consumption and birds)	grams (g)	" 36-37
	kilograms (kg)	" 36-37
Costs	cost per kilogram	" 49



Sheep

Weight of animals for slaughter will be recorded to the nearest 0.5 kg, with cut-off points at 0.25 kg.

MEAT GRADES ARE

	Class	Grade Mark	Weight from kg	Weight to kg
1. LAMB	Prime	D	8.0	12.5
		2	13.0	16.0
		8	16.5	19.0
		4	19.5	25.5
	Omega	D	8.0	12.5
		2	13.0	16.0
	Y's	YL	8.0	12.5
		YM	13.0	16.0
		YH	16.5	25.5
	Alpha	Alpha	6.5	12.5
2. MUTTON Hogget	Prime	H1	22.0	and under
		H7	22.5	26.0
	FAQ	HX	22.0	and under
(Any FAQ Hoggets 22.5 kg and over to be included in Wether FAQ Grade X.)				
Wether	Prime	1	22.0	and under
		7	22.5	26.0
		3	26.5	30.0
		9	30.5	36.0
	FAQ	X	26.0	and under
(Any FAQ Wethers 26.5 kg and over to be included in "Overfat" grade.)				



Conversion tables

This section contains only those conversion tables you are most likely to need for everyday situations. The figures have been rounded off to give workable conversions and are sufficiently accurate for most farming activities. In some instances they may give a greater accuracy than is needed and you will therefore have to round them to the degree of precision you require. For example, 50 chains are 1005.8 metres; rounded to the nearest whole number this is 1006 metres, but you may only need accuracy to the nearest 10 metres (approx. 1/2 chain) and so would call this 1010 metres.

If you require a more comprehensive set of tables, you will find them in the Standards Association of New Zealand publication "Metrication Factors and Tables for Conversion of S.I. Units", NZS 6502.

(* Any prime ewes 36.5 kg and over and FAQ ewes 26.5 kg and over to be included in "Overfat" grade.)

You will need to calculate

Weight (livestock and wool yields)	<i>in metric terms</i> kilograms (kg)	see p. 36-37
Costs	cost per kilogram	49

To convert ewe equivalents per acre to per hectare, multiply the ewe equivalent number by 2.47 (or, for rough conversion, by 2.5).

How to use these tables

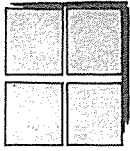
The tables in this book are set out with imperial figures across the top and down the left-hand side. The metric conversions, in columns, take up the centre of the tables.

Use the imperial figures across the top and down the side to add up to the figure you want to convert. The metric conversion is the figure in line with both imperial numbers.

For example: In the table "Acres to hectares" (see p. 29) there are 0 to 90 acres across the top and 0 to 1000 acres down the left-hand side. To convert 330 acres to hectares, read across from the number 300 to the column headed 30. The figure in this column gives you the number of hectares (133.5).

If you wish to convert 70 acres, read the number directly below 70, in line with 0 on the left hand side.

The auxiliary tables provide extra conversions which you can add to those in the main table. For example, if you wish to convert 64 acres to hectares, look up 60 acres in the main table = 24.3 ha. Then look up 4 in the auxiliary table = 1.6 ha. Your answer is therefore 25.9 (or 26) ha.



Area

METRIC AND IMPERIAL EQUIVALENTS

This diagram shows how to use the tables:

CHAINS TO METRES

Chains	0	1	2	3	4	5	6	7	8	9
0	0.0	20.1	40.2	60.4	80.5	100.6	120.7	140.8	160.9	181.1
10	201.2	221.3	241.4	261.5	281.6	301.8	321.9	342.0	362.1	382.2
20	402.3	422.5	442.6	462.7	482.8	502.9	523.0	543.2	563.3	583.4
30	603.5	623.6	643.7	663.9	684.0	704.1	724.2	744.3	764.4	784.6
40	804.7	824.8	844.9	865.0	885.1	905.3	925.4	945.5	965.6	985.7
50	1005.8	1026.0	1046.1	1066.2	1086.3	1106.4	1126.5	1146.7	1166.8	1186.9
60	1207.0	1227.1	1247.2	1267.4	1287.5	1307.6	1327.7	1347.8	1367.9	1388.1
70	1408.2	1428.3	1448.4	1468.5	1488.6	1508.8	1528.9	1549.0	1569.1	1589.2
80	1609.3	1629.5	1649.6	1669.7	1689.8	1709.9	1730.0	1750.2	1770.3	1790.4
90	1810.5	1830.6	1850.7	1870.9	1891.0	1911.1	1931.2	1951.4	1971.4	1991.6

3 chains = 60.4 metres

44 chains = 885.1 metres

98 chains = 1971.4 metres

Metric to Imperial

- 1 cm² = 0.155 square inch
- 1 m² = 10.76 square feet
- 1 m² = 1.196 square yards
- 1 m² = 0.039 54 perch
- 1 ha = 2.471 acres
- 1 km² = 0.386 1 square mile
- (1 km² = 100 ha. 1 ha = 10 000 m²)

Imperial to Metric

- 1 square inch = 6.452 cm²
- 1 square foot = 0.092 90 m²
- 1 square yard = 0.836 1 m²
- 1 perch = 25.29 m²
- 1 acre = 0.404 7 ha
- 1 square mile = 2.590 km²

For rough, quick conversions:

- square inches $\times \frac{25}{9}$ = cm² + 3.3
- square yards $\times \frac{5}{6}$ = m² + 0.3
- perches $\times 25$ = m² - 1.1
- acres $\times \frac{4}{10}$ = ha - 1.2
- square miles $\times \frac{5}{2}$ = km² - 3.5

SQUARE FEET TO SQUARE METRES

Sq Ft	0	10	20	30	40	50	60	70	80	90	
	Square Metres										
0	—	0.93	1.86	2.79	3.72	4.65	5.57	6.50	7.43	8.36	
100	9.29	10.22	11.15	12.08	13.01	13.94	14.86	15.79	16.72	17.65	
200	18.58	19.51	20.44	21.37	22.30	23.23	24.15	25.08	26.01	26.94	
300	27.87	28.80	29.73	30.66	31.59	32.52	33.45	34.37	35.30	36.23	
400	37.16	38.09	39.02	39.95	40.88	41.81	42.74	43.66	44.59	45.52	
500	46.45	47.38	48.31	49.24	50.17	51.10	52.03	52.95	53.88	54.81	
600	55.74	56.67	57.60	58.53	59.46	60.39	61.32	62.24	63.17	64.10	
700	65.03	65.96	66.89	67.82	68.75	69.68	70.61	71.54	72.46	73.39	
800	74.32	75.25	76.18	77.11	78.04	78.97	79.90	80.83	81.75	82.68	
900	83.61	84.54	85.47	86.40	87.33	88.26	89.19	90.12	91.04	91.97	

AUXILIARY TABLE

Sq Ft	0	1	2	3	4	5	6	7	8	9	
	Square Metres										
—	0.09	0.19	0.28	0.37	0.47	0.56	0.65	0.74	0.84		

SQUARE YARDS TO SQUARE METRES

Sq Yds	0	10	20	30	40	50	60	70	80	90	
	Square Metres										
0	—	8.4	16.7	25.1	33.4	41.8	50.2	58.5	66.9	75.3	
100	83.6	92.0	100.3	108.7	117.1	125.4	133.8	142.1	150.5	158.9	
200	167.2	175.6	183.9	192.3	200.7	209.0	217.4	225.8	234.1	242.5	
300	250.8	259.2	267.6	275.9	284.3	292.6	301.0	309.4	317.7	326.1	
400	334.5	342.8	351.2	359.5	367.9	376.3	384.6	393.0	401.3	409.7	
500	418.1	426.4	434.8	443.1	451.5	459.9	468.2	476.6	485.0	493.3	
600	501.7	510.0	518.4	526.8	535.1	543.5	551.8	560.2	568.6	576.9	
700	585.3	593.6	602.0	610.4	618.7	627.1	635.5	643.8	652.2	660.5	
800	668.9	677.3	685.6	694.0	702.3	710.7	719.1	727.4	735.8	744.2	
900	752.5	760.9	769.2	777.6	786.0	794.3	802.7	811.0	819.4	827.8	

AUXILIARY TABLE

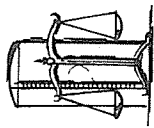
Sq Yds	0	1	2	3	4	5	6	7	8	9	
	Square Metres										
—	0.8	1.7	2.5	3.3	4.2	5.0	5.9	6.7	7.5		

ACRES TO HECTARES

Acres	0	10	20	30	40	50	60	70	80	90	
	Hectares										
0	—	4.0	8.1	12.1	16.2	20.2	24.3	28.3	32.4	36.4	
100	40.5	44.5	48.6	52.6	56.7	60.7	64.7	68.8	72.8	76.9	
200	80.9	85.0	89.0	93.1	97.1	101.2	105.2	109.3	113.3	117.4	
300	121.4	125.5	129.5	133.5	137.6	141.6	145.7	149.7	153.8	157.8	
400	161.9	165.9	170.0	174.0	178.1	182.1	186.2	190.2	194.2	198.3	
500	202.3	206.4	210.4	214.5	218.5	222.6	226.6	230.7	234.7	238.9	
600	242.8	246.9	250.9	255.0	259.0	263.0	267.1	271.1	275.2	279.2	
700	283.3	287.3	291.4	295.4	299.5	303.5	307.6	311.6	315.7	319.7	
800	323.7	327.8	331.8	335.9	339.9	344.0	348.0	352.1	356.1	360.2	
900	364.2	368.3	372.3	376.4	380.4	384.5	388.5	392.5	396.6	400.6	
1000	404.7	—	—	—	—	—	—	—	—	—	

AUXILIARY TABLE

Acres	0	1	2	3	4	5	6	7	8	9	
	Hectares										
—	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6		



Density

METRIC AND IMPERIAL EQUIVALENTS

Metric to Imperial

- 1 g/cm³ = 0.036 13 pound/cu. inch
- 1 g/cm³ = 62.43 pound/cu. foot
- 1 kg/m³ = 0.062 43 pound/cu. foot
- 1 g/litre = 0.160 4 ounce/gallon
- 1 g/litre = 0.010 02 pound/gallon

Imperial to Metric

- 1 pound/cu. inch = 27.68 g/m³
- 1 pound/cu. foot = 0.016 02 g/cm³
- 1 pound/cu. foot = 16.02 kg/m³
- 1 ounce/gallon = 6.236 g/litre
- 1 pound/gallon = 99.78 g/litre

For rough, quick conversions:

- pounds per cubic foot × 16 = kg/m³ % error - 0.1
- ounces per gallon × 6 = g/litre % error - 3.8
- pounds per gallon × 100 = g/litre % error - 0.2

OUNCES PER 100 GALLONS TO GRAMS/100 LITRES

Oz/100 Gal	0	1	2	3	4	5	6	7	8	9
	Grams/100 Litres									
0	—	6.24	12.47	18.71	24.94	31.18	37.42	43.65	49.89	56.12
10	62.36	68.60	74.83	81.07	87.30	93.54	99.78	106.01	112.25	118.48

POUNDS PER 100 GALLONS TO GRAMS/100 LITRES

Lb/100 Gal	0	1	2	3	4	5	6	7	8	9
	Grams/100 Litres									
0	—	100	200	299	399	499	599	698	798	898
10	998	1098	1197	1297	1397	1497	1596	1696	1796	1896

FLUID OUNCES PER 100 GALLONS TO MILLILITRES/100 LITRES

Fluid oz/100 Gal	0	1	2	3	4	5	6	7	8	9
	Millilitres/100 Litres									
0	—	6.25	12.50	18.75	25.00	31.25	37.50	43.75	50.00	56.25
10	62.50	68.75	75.00	81.25	87.50	93.75	100.00	106.25	112.50	118.75

PINTS PER 100 GALLONS TO MILLILITRES/100 LITRES

Pints/100 Gal	0	1	2	3	4	5	6	7	8	9
	Millilitres/100 Litres									
0	—	125	250	375	500	625	750	875	1000	1125
10	1250	1375	1500	1625	1750	1875	2000	2125	2250	2375

Note: 20 fluid ounces are 1 pint.



Energy

METRIC AND IMPERIAL EQUIVALENTS

Metric to Imperial

- 1 kJ/kg = 0.108 3 kilocalorie/pound
- 1 kJ = 0.238 8 kilocalorie
- 1 kW = 1.341 horsepower

Imperial to Metric

- 1 kilocalorie/pound = 9.230 kJ/kg
- 1 kilocalorie = 4.187 kJ
- 1 horsepower = 0.745 7 kW

For rough, quick conversions:

- kilocalories × 4 = kJ
 - horsepower × ¾ = kW
- % error
 - 4.5
 - 0.6

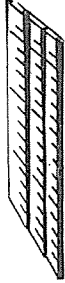
The watt is the power used when work is done or energy expended at the rate of one joule per second.

HORSEPOWER TO KILOWATTS

Hp	0	10	20	30	40	50	60	70	80	90
0	—	7	15	22	30	37	45	52	60	67
100	75	82	89	97	104	112	119	127	134	142
200	149	157	164	172	179	186	194	201	209	216

AUXILIARY TABLE

Hp	0	1	2	3	4	5	6	7	8	9
—	0.7	1.5	2.2	3.0	3.7	4.5	5.2	6.0	6.7	



Length

METRIC AND IMPERIAL EQUIVALENTS

Metric to Imperial

- 1 mm = 0.039 37 inch
- 1 cm = 0.393 7 inch
- 1 m = 3.281 feet
- 1 m = 1.094 yards
- 1 m = 0.049 71 chain
- 1 m = 0.004 971 furlong
- 1 km = 0.621 4 mile

Imperial to Metric

- 1 inch = 25.4 mm
- 1 inch = 2.54 cm
- 1 foot = 0.304 8 m
- 1 yard = 0.914 4 m
- 1 chain = 20.12 m
- 1 furlong = 201.2 m
- 1 mile = 1.609 km

For rough, quick conversions:

- inches × $\frac{10}{4}$ = cm
 - feet × $\frac{3}{10}$ = m
 - yards × $\frac{9}{10}$ = m
 - chains × 20 = m
 - miles × $\frac{8}{5}$ = km
- % error
 - 1.6
 - 1.6
 - 1.6
 - 0.6
 - 0.6

FRACTIONS OF INCHES AND INCHES TO MILLIMETRES

inches	mm	inches	mm	inches	mm	inches	mm
1/16	1.6	1/2	12.7	1	25	8	203
1/8	3.2	9/16	14.3	2	51	9	229
3/16	4.8	5/8	15.9	3	76	10	254
1/4	6.4	11/16	17.5	4	102	11	279
5/16	7.9	3/4	19.1	5	127	12	305
3/8	9.5	13/16	20.6	6	152		
7/16	11.1	7/8	22.2	7	178		

Note: To convert inches to centimetres divide the numbers in the above table by 10.

FEET TO METRES

Feet	0	1	2	3	4	5	6	7	8	9
	Metres									
0	—	0.305	0.610	0.914	1.219	1.524	1.829	2.134	2.438	2.743
10	3.048	3.353	3.658	3.962	4.267	4.572	4.877	5.182	5.486	5.791
20	6.096	6.401	6.706	7.010	7.315	7.620	7.925	8.230	8.534	8.839
30	9.144	9.449	9.754	10.058	10.363	10.668	10.973	11.278	11.582	11.887
40	12.192	12.497	12.802	13.106	13.411	13.716	14.021	14.326	14.630	14.935
50	15.240	—	—	—	—	—	—	—	—	—

Note: For conversion of feet to millimetres, multiply the numbers in the above table by 1000. To convert feet to centimetres multiply the numbers by 100.

YARDS TO METRES

Yards	0	10	20	30	40	50	60	70	80	90
	Metres									
0	—	9.14	18.29	27.43	36.58	45.72	54.86	64.01	73.15	82.30
100	91.44	100.58	109.73	118.87	128.02	137.16	146.30	155.45	164.59	173.74
200	182.88	192.02	201.17	210.31	219.46	228.60	237.74	246.89	256.03	265.18
300	274.32	283.46	292.61	301.75	310.90	320.04	329.18	338.33	347.47	356.62
400	365.76	374.90	384.05	393.19	402.34	411.48	420.62	429.77	438.91	448.06
500	457.20	466.34	475.49	484.63	493.78	502.92	512.06	521.21	530.35	539.50
600	548.64	557.78	566.93	576.07	585.22	594.36	603.50	612.65	621.79	630.94
700	640.08	649.22	658.37	667.51	676.66	685.80	694.94	704.09	713.23	722.38
800	731.52	740.66	749.81	758.95	768.10	777.24	786.38	795.53	804.67	813.82
900	822.96	832.10	841.25	850.39	859.54	868.68	877.82	886.97	896.11	905.26

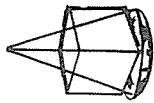
CHAINS TO METRES

Chains	0	1	2	3	4	5	6	7	8	9
	Metres									
0	—	20.1	40.2	60.4	80.5	100.6	120.7	140.8	160.9	181.1
10	201.2	221.3	241.4	261.5	281.6	301.8	321.9	342.0	362.1	382.2
20	402.3	422.5	442.6	462.7	482.8	502.9	523.0	543.2	563.3	583.4
30	603.5	623.6	643.7	663.9	684.0	704.1	724.2	744.3	764.4	784.6
40	804.7	824.8	844.9	865.0	885.1	905.3	925.4	945.5	965.6	985.7
50	1005.8	1026.0	1046.1	1066.2	1086.3	1106.4	1126.5	1146.7	1166.8	1186.9
60	1207.0	1227.1	1247.2	1267.3	1287.4	1307.5	1327.6	1347.7	1367.8	1387.9
70	1408.2	1428.3	1448.4	1468.5	1488.6	1508.7	1528.8	1548.9	1569.0	1589.1
80	1609.3	1629.5	1649.6	1669.7	1689.8	1709.9	1730.0	1750.2	1770.3	1790.4
90	1810.5	1830.6	1850.7	1870.9	1891.0	1911.1	1931.2	1951.3	1971.4	1991.6

MILES TO KILOMETRES

Miles	0	1	2	3	4	5	6	7	8	9
	Kilometres									
0	—	1.61	3.22	4.83	6.44	8.05	9.66	11.27	12.87	14.48
10	16.09	17.70	19.31	20.92	22.53	24.14	25.75	27.36	28.97	30.58
20	32.19	33.80	35.41	37.01	38.62	40.23	41.84	43.45	45.06	46.67
30	48.28	49.89	51.50	53.11	54.72	56.33	57.94	59.55	61.16	62.76
40	64.37	65.98	67.59	69.20	70.81	72.42	74.03	75.64	77.25	78.86
50	80.47	—	—	—	—	—	—	—	—	—

Use this table to convert miles per hour to kilometres per hour.



Mass (weight)

METRIC AND IMPERIAL EQUIVALENTS

Metric to Imperial

- 1 g = 0.035 27 ounce
- 1 kg = 2.205 pounds
- 1 kg = 0.019 68 hundredweight
- 1 t = 0.984 2 ton (long)
- 1 t = 1.102 3 tons (short)
- (1 t = 1 000 kg)

Imperial to Metric

- 1 ounce = 28.35 g
- 1 pound = 0.453 6 kg
- 1 hundredweight = 50.80 kg
- 1 ton (long) = 1.016 t
- 1 ton (short) = 0.907 2 t

For rough, quick conversions:

- ounces × 30 = g
 - pounds × $\frac{4}{9}$ = kg
 - hundredweights × 50 = kg
 - tons (long) × 1 = t
- % error
- + 5.8
 - 2.0
 - 1.6
 - 1.6

OUNCES TO GRAMS

Ounces	0	1	2	3	4	5	6	7	8	9
0	—	28.4	56.7	85.0	113.4	141.7	170.1	198.4	226.8	255.1
10	283.5	311.8	340.2	368.5	396.9	425.2	453.6	481.9	510.3	538.6

POUNDS TO KILOGRAMS

Lbs	0	10	20	30	40	50	60	70	80	90
0	—	4.5	9.1	13.6	18.1	22.7	27.2	31.8	36.3	40.8
100	45.4	49.9	54.4	59.0	63.5	68.0	72.6	77.1	81.6	86.2
200	90.7	95.3	99.8	104.3	108.9	113.4	117.9	122.5	127.0	131.5
300	136.1	140.6	145.1	149.7	154.2	158.8	163.3	167.8	172.4	176.9
400	181.4	186.0	190.5	195.0	199.6	204.1	208.7	213.2	217.7	222.3
500	226.8	231.3	235.9	240.4	244.9	249.5	254.0	258.5	263.1	267.6
600	272.2	276.7	281.2	285.8	290.3	294.8	299.4	303.9	308.4	313.0
700	317.5	322.1	326.6	331.1	335.7	340.2	344.7	349.3	353.8	358.3
800	362.9	367.4	371.9	376.5	381.0	385.6	390.1	394.6	399.2	403.7
900	408.2	412.8	417.3	421.8	426.4	430.9	435.4	440.0	444.5	449.1

AUXILIARY TABLE

Lb	0	1	2	3	4	5	6	7	8	9
	—	0.5	0.9	1.4	1.8	2.3	2.7	3.2	3.6	4.1

HUNDREDWEIGHTS TO KILOGRAMS

Cwt	0	1	2	3	4	5	6	7	8	9
0	—	51	102	152	203	254	305	356	406	457
10	508	559	610	660	711	762	813	864	914	965
20	1 016	—	—	—	—	—	—	—	—	—

Note: 1000 kilograms = 1 tonne.

Mass per unit area

METRIC AND IMPERIAL EQUIVALENTS

Metric to Imperial

- 1 g/m² = 0.029 49 ounce/sq. yard
- 1 g/m² = 8.922 pounds/acre
- 1 kg/ha = 0.892 2 pound/acre
- 1 t/ha = 7.97 hundredweights/acre

Imperial to Metric

- 1 ounce/sq. yard = 33.91 g/m²
- 1 pound/acre = 0.112 1 g/m²
- 1 pound/acre = 1.121 kg/ha
- 1 hundredweight/acre = 0.125 5 t/ha

For rough, quick conversions:

- ounces per square yard $\times \frac{100}{3}$ = g/m² % error - 1.7
- pounds per acre $\times \frac{11}{100}$ = g/m² - 1.9
- pounds per acre $\times \frac{11}{10}$ = kg/ha - 1.9
- tons per acre $\times \frac{10}{4}$ = t/ha - 0.4

POUNDS PER ACRE TO KILOGRAMS/HECTARE

Lb/Acre	0	1	2	3	4	5	6	7	8	9
	Kilograms/Hectare									
0	—	1.1	2.2	3.4	4.5	5.6	6.7	7.8	9.0	10.1
10	11.2	12.3	13.5	14.6	15.7	16.8	17.9	19.1	20.2	21.3
20	22.4	23.5	24.7	25.8	26.9	28.0	29.1	30.3	31.4	32.5
30	33.6	34.7	35.9	37.0	38.1	39.2	40.4	41.5	42.6	43.7
40	44.8	46.0	47.1	48.2	49.3	50.4	51.6	52.7	53.8	54.9
50	56.0	57.2	58.3	59.4	60.5	61.6	62.8	63.9	65.0	66.1
60	67.3	68.4	69.5	70.6	71.7	72.9	74.0	75.1	76.2	77.3
70	78.5	79.6	80.7	81.8	82.9	84.1	85.2	86.3	87.4	88.5
80	89.7	90.8	91.9	93.0	94.2	95.3	96.4	97.5	98.6	99.8
90	100.9	102.0	103.1	104.2	105.4	106.5	107.6	108.7	109.8	111.0

AUXILIARY TABLE

Lb/Acre	0	1/4	1/2	3/4	28	56	100	112
	Kilograms/Hectare							
—	0.28	0.56	0.84	31.4	62.8	112.1	125.5	

HUNDREDWEIGHTS PER ACRE TO KILOGRAMS/HECTARE

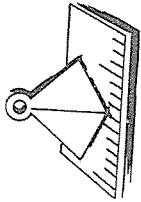
Cwt/Acre	0	1	2	3	4	5	6	7	8	9
	Kilograms/Hectare									
0	—	126	251	377	502	628	753	879	1 004	1 130
10	1 255	1 381	1 506	1 632	1 758	1 883	2 009	2 134	2 260	2 385

AUXILIARY TABLE

Cwt/Acre	0	1/4	1/2	3/4	20
	Kilograms/Hectare				
—	31	63	94	2 511	

TONS PER ACRE TO TONNES/HECTARE

Ton/Acre	0	1	2	3	4	5	6	7	8	9
	Tonnes/Hectare									
—	2.5	5.0	7.5	10.0	12.6	15.1	17.6	20.1	22.6	



Mass per unit length

METRIC AND IMPERIAL EQUIVALENTS

Metric to Imperial

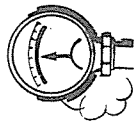
1 kg/m = 0.056 00 pound/inch
 1 kg/m = 0.6720 pound/foot

Imperial to Metric

1 pound/inch = 17.86 kg/m
 1 pound/foot = 1.488 kg/m

For rough, quick conversions:

pounds per foot $\times \frac{3}{2}$ = kg/m % error + 0.8
 pounds per inch $\times 18$ = kg/m + 0.8



Pressure

METRIC AND IMPERIAL EQUIVALENTS

Metric to Imperial

1 kPa = 0.145 0 pound force/square inch

Imperial to Metric

1 pound force/square inch = 6.895 kPa

For rough, quick conversions:

pounds force per square inch $\times 7$ = kPa % error + 1.5

Atmospheric pressure: This will be given in millibars.

1 millibar = 0.029 53 barometric inch mercury
 1 bar = 10 kPa

The pascal is the pressure or stress which arises when a force of one newton is applied uniformly over an area of one square metre.

INCHES OF MERCURY TO KILOPASCALS

inches mercury	kPa	inches mercury	kPa	inches mercury	kPa	inches mercury	kPa	inches mercury	kPa
1/2	1.7	4 1/2	15.2	8 1/2	28.8	12 1/2	42.3	16 1/2	55.9
1	3.4	5	16.9	9	30.5	13	44.0	17	57.6
1 1/2	5.1	5 1/2	18.6	9 1/2	32.2	13 1/2	45.7	17 1/2	59.3
2	6.8	6	20.3	10	33.9	14	47.4	18	61.0
2 1/2	8.5	6 1/2	22.0	10 1/2	35.6	14 1/2	49.1	18 1/2	62.6
3	10.2	7	23.7	11	37.3	15	50.8	19	64.3
3 1/2	11.9	7 1/2	25.4	11 1/2	38.9	15 1/2	52.5	19 1/2	66.0
4	13.5	8	27.1	12	40.6	16	54.2	20	67.7

POUNDS FORCE PER SQUARE INCH TO KILOPASCALS

Lb/ Sq in	0	10	20	30	40	50	60	70	80	90
	Kilopascals									
0	—	68.9	138	207	276	345	414	483	552	621
100	689	758	827	896	965	1034	1103	1172	1241	1310
200	1379	1448	1517	1586	1655	1724	1793	1862	1931	1999

AUXILIARY TABLE

Lb/ Sq in	0	1	2	3	4	5	6	7	8	9
	Kilopascals									
—	—	6.9	13.8	20.7	27.6	34.5	41.4	48.3	55.2	62.1

GALLONS TO LITRES

Gals	0	10	20	30	40	50	60	70	80	90
0	—	45	91	136	182	227	273	318	364	409
100	455	500	546	591	636	682	727	773	818	864
200	909	955	1000	1046	1091	1137	1182	1227	1273	1318
300	1364	1409	1455	1500	1546	1591	1637	1682	1728	1773
400	1818	1864	1909	1955	2000	2046	2091	2137	2182	2228
500	2273	2319	2364	2409	2455	2500	2546	2591	2637	2682
600	2728	2773	2819	2864	2909	2955	3000	3046	3091	3137
700	3182	3228	3273	3319	3364	3410	3455	3500	3546	3591
800	3637	3682	3728	3773	3819	3864	3910	3955	4001	4046
900	4091	4137	4182	4228	4273	4319	4364	4410	4455	4501

AUXILIARY TABLE

Gals	0	1	2	3	4	5	6	7	8	9
—	4.5	9.1	13.6	18.2	22.7	27.3	31.8	36.4	40.9	

CUBIC FEET TO CUBIC METRES

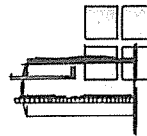
Cubic Feet	0	10	20	30	40	50	60	70	80	90
0	—	0.28	0.57	0.85	1.13	1.42	1.70	1.98	2.27	2.55
100	2.83	3.11	3.40	3.68	3.96	4.25	4.53	4.81	5.10	5.38
200	5.66	5.95	6.23	6.51	6.80	7.08	7.36	7.65	7.93	8.21
300	8.50	8.78	9.06	9.34	9.63	9.91	10.19	10.48	10.76	11.04
400	11.33	11.61	11.89	12.18	12.46	12.74	13.03	13.31	13.59	13.88
500	14.16	14.44	14.72	15.01	15.29	15.57	15.86	16.14	16.42	16.71
600	16.99	17.27	17.56	17.84	18.12	18.41	18.69	18.97	19.26	19.54
700	19.82	20.10	20.39	20.67	20.95	21.24	21.52	21.80	22.09	22.37
800	22.65	22.94	23.22	23.50	23.79	24.07	24.35	24.64	24.92	25.20
900	25.49	25.77	26.05	26.33	26.62	26.90	27.18	27.47	27.75	28.03

AUXILIARY TABLE

Cubic Feet	0	1	2	3	4	5	6	7	8	9
—	0.03	0.06	0.09	0.11	0.14	0.17	0.20	0.23	0.25	

CUBIC YARDS TO CUBIC METRES

Cubic Yards	0	1	2	3	4	5	6	7	8	9
0	—	0.8	1.5	2.3	3.1	3.8	4.6	5.4	6.1	6.9
10	7.6	8.4	9.2	9.9	10.7	11.5	12.2	13.0	13.8	14.5
20	15.3	16.1	16.8	17.6	18.3	19.1	19.9	20.6	21.4	22.2
30	22.9	23.7	24.5	25.2	26.0	26.8	27.5	28.3	29.1	29.8
40	30.6	31.3	32.1	32.9	33.6	34.4	35.2	35.9	36.7	37.5
50	38.2	39.0	39.8	40.5	41.3	42.1	42.8	43.6	44.3	45.1
60	45.9	46.6	47.4	48.2	48.9	49.7	50.5	51.2	52.0	52.8
70	53.5	54.3	55.0	55.8	56.6	57.3	58.1	58.9	59.6	60.4
80	61.2	61.9	62.7	63.5	64.2	65.0	65.8	66.5	67.3	68.0
90	68.8	69.6	70.3	71.1	71.9	72.6	73.4	74.2	74.9	75.7
100	76.5	—	—	—	—	—	—	—	—	—

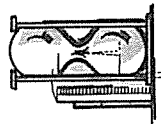


Volume/Area

METRIC AND IMPERIAL EQUIVALENTS

Metric to Imperial *Imperial to Metric*
 1 litre/ha = 0.712 1 pint/acre 1 pint/acre = 1.404 litres/ha
 1 litre/ha = 0.089 02 gallon/acre 1 gallon/acre = 11.23 litres/ha

For rough, quick conversions:
 gallons/acre × 11 = litres/ha % error — 2.0



Volume/Time (Volume rate of flow)

METRIC AND IMPERIAL EQUIVALENTS

Metric to Imperial
 1 m³/s = 35.31 cubic feet/second
 1 m³/h = 0.009 810 cubic foot/second
 1 m³/h = 219.97 gallons/hour
 1 litre/s = 0.035 31 cubic foot/second
 1 litre/h = 0.003 666 gallon/minute
 1 litre/h = 0.220 0 gallon/hour

Imperial to Metric
 1 cubic foot/second = 0.028 32 m³/s
 1 cubic foot/second = 101.9 m³/h
 1 gallon/hour = 0.004 546 m³/h
 1 cubic foot/second = 28.32 litres/s
 1 gallon/minute = 272.8 litres/h
 1 gallon/hour = 4.546 litres/h

For rough, quick conversions:

gallons per hour $\times \frac{9}{2000}$ = m³/h + 1.0
 gallons per minute $\times \frac{9}{11}$ = m³/h + 0.02
 gallons per hour $\times \frac{9}{2}$ = litres/h + 1.0
 cusecs $\times 30$ = litres/s + 5.9

FLUID OUNCES PER ACRE TO MILLILITRES/HECTARE

Fluid oz/ Acre	0	1	2	3	4	5	6	7	8	9
0	—	70	140	210	280	350	420	490	560	630
10	700	770	840	910	980	1050	1120	1190	1260	1330
20	1400	—	—	—	—	—	—	—	—	—

PINTS PER ACRE TO LITRES/HECTARE

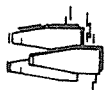
Pints/Acre	0	1	2	3	4	5	6	7	8	9
0	—	1.4	2.8	4.2	5.6	7.0	8.4	9.8	11.2	12.6
10	14.0	15.4	16.9	18.3	19.7	21.1	22.5	23.9	25.3	26.7

GALLONS PER ACRE TO LITRES/HECTARE

Gal/Acre	0	1	2	3	4	5	6	7	8	9
0	—	11.2	22.5	33.7	44.9	56.2	67.4	78.6	89.9	101.1
10	112.3	123.6	134.8	146.0	157.3	168.5	179.7	191.0	202.2	213.4
20	224.7	235.9	247.1	258.4	269.6	280.8	292.1	303.3	314.5	325.8
30	337.0	348.2	359.5	370.7	381.9	393.2	404.4	415.6	426.9	438.1
40	449.3	460.6	471.8	483.0	494.3	505.5	516.7	528.0	539.2	550.4
50	561.7	572.9	584.1	595.4	606.6	617.9	629.1	640.3	651.6	662.8
60	674.0	685.3	696.5	707.7	719.0	730.2	741.4	752.7	763.9	775.1
70	786.4	797.6	808.8	820.1	831.3	842.5	853.8	865.0	876.2	887.5
80	898.7	909.9	921.2	932.4	943.6	954.9	966.1	977.3	988.6	999.8
90	1011.0	1022.3	1033.5	1044.7	1056.0	1067.2	1078.4	1089.7	1100.9	1112.1

AUXILIARY TABLE

Gal/Acre	100	200	400
1123	2247	4493	



Milk measure

POUNDS OF MILK TO LITRES

Lb Milk	0	10	20	30	40	50	60	70	80	90
0	—	4	9	13	18	22	26	31	35	40
100	44	49	53	57	62	66	71	75	79	84
200	88	93	97	102	106	110	115	119	124	128
300	132	137	141	146	150	154	159	163	168	172
400	177	181	185	190	194	199	203	207	212	216
500	221	225	230	234	238	243	247	252	256	260
600	265	269	274	278	282	287	291	296	300	305
700	309	313	318	322	327	331	335	340	344	349
800	353	358	362	366	371	375	380	384	388	393
900	397	402	406	410	415	419	424	428	433	437

AUXILIARY TABLE

Lb Milk	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
0	—	441	883	1324	1765	2207	2648	3090	3531	3972
10000	4414	4855	5296	5738	6179	6621	7062	7503	7945	8386

Official conversion factors: 1 lb milk = 0.441 367 96 litre
 1 litre milk = 2.265 680 7 lb



Cost conversions

To calculate costs of metric quantities, use the following factors:

Cost per pound \times 2.2 = Cost per kilogram
 Cost per kilogram \div 2.2 = Cost per pound

Cost per hundredweight \div 50.8 = Cost per kilogram
 Cost per kilogram \times 50.8 = Cost per hundredweight

Cost per long ton is almost equivalent to cost per tonne

Cost per short ton \times 1.1 = Cost per tonne
 Cost per tonne \div 1.1 = Cost per short ton

Cost per gallon \div 4.5 = Cost per litre
 Cost per litre \times 4.5 = Cost per gallon

Cost per acre \times 2.47 = Cost per hectare
 Cost per hectare \div 2.47 = Cost per acre

Cost per yard \times 1.09 = Cost per metre
 Cost per metre \div 1.09 = Cost per yard

Cost per chain \div 20.12 = Cost per metre
 Cost per metre \times 20.12 = Cost per chain

Cost per mile \div 1.6 = Cost per kilometre
 Cost per kilometre \times 1.6 = Cost per mile