

Square and cube functions

Locate the x^2 and x^3 functions on your calculator and then check the following worked examples.

Problem 1. Evaluate 2.4^2

(i) Type in 2.4

(ii) Press x^2 and 2.4^2 appears on the screen.

(iii) Press = and the answer $\frac{144}{25}$ appears

(iv) Press the $S \leftrightarrow D$ function and the fraction changes to a decimal: 5.76

Alternatively, after step (ii) press Shift and = . Thus, $2.4^2 = 5.76$

Problem 2. Evaluate 0.17^2 in engineering form

(i) Type in 0.17.

(ii) Press x^2 and 0.17^2 appears on the screen.

(iii) Press Shift and = and the answer 0.0289 appears.

(iv) Press the ENG function and the answer changes to 28.9×10^{-3} , which is **engineering form**.

Problem 3. Change 348620 into engineering form

(i) Type in 348620

(ii) Press = then ENG.

Hence, **$348620 = 348.62 \times 10^3$** in engineering form.

Problem 4. Change 0.0000538 into engineering form

(i) Type in 0.0000538

(ii) Press = then ENG.

Hence, **$0.0000538 = 53.8 \times 10^{-6}$** in engineering form.

Problem 5. Evaluate 1.4^3

(i) Type in 1.4

(ii) Press x^3 and 1.4^3 appears on the screen.

(iii) Press = and the answer $\frac{343}{125}$ appears.

(iv) Press the $S \Leftrightarrow D$ function and the fraction changes to a decimal: 2.744

Thus, **$1.4^3 = 2.744$**

Now try the following Practice Exercise

Practice Exercise Square and cube functions

1. Evaluate 3.5^2
2. Evaluate 0.19^2
3. Evaluate 6.85^2 correct to 3 decimal places.
4. Evaluate $(0.036)^2$ in engineering form.
5. Evaluate 1.563^2 correct to 5 significant figures.
6. Evaluate 1.3^3
7. Evaluate 3.14^3 correct to 4 significant figures.
8. Evaluate $(0.38)^3$ correct to 4 decimal places.
9. Evaluate $(6.03)^3$ correct to 2 decimal places.
10. Evaluate $(0.018)^3$ in engineering form.

Reciprocal and power functions

The reciprocal of 2 is $\frac{1}{2}$, the reciprocal of 9 is $\frac{1}{9}$ and the reciprocal of x is $\frac{1}{x}$, which from indices may be written as x^{-1} . Locate the reciprocal, i.e. x^{-1} , on the calculator. Also, locate the power function, i.e. x^{\square} , on your calculator and then check the following worked examples.

Problem 6. Evaluate $\frac{1}{3.2}$

(i) Type in 3.2

(ii) Press x^{-1} and 3.2^{-1} appears on the screen.

(iii) Press = and the answer $\frac{5}{16}$ appears.

(iv) Press the S \leftrightarrow D function and the fraction changes to a decimal: 0.3125

Thus, $\frac{1}{3.2} = 0.3125$

Problem 7. Evaluate 1.5^5 correct to 4 significant figures

- (i) Type in 1.5
- (ii) Press x^{\square} and 1.5 \square appears on the screen.
- (iii) Press 5 and 1.5^5 appears on the screen.
- (iv) Press Shift and = and the answer 7.59375 appears.

Thus, $1.5^5 = 7.594$, correct to 4 significant figures.

Problem 8. Evaluate $2.4^6 - 1.9^4$ correct to 3 decimal places

- (i) Type in 2.4
- (ii) Press x^{\square} and 2.4 \square appears on the screen.
- (iii) Press 6 and 2.4^6 appears on the screen.
- (iv) The cursor now needs to be moved; this is achieved by using the cursor key (the large blue circular function in the top center of the calculator). Press \rightarrow
- (v) Press -
- (vi) Type in 1.9, press x^{\square} , then press 4
- (vii) Press = and the answer 178.07087... appears.

Thus, $2.4^6 - 1.9^4 = 178.071$, correct to 3 decimal places.

Now try the following Practice Exercise

Practice Exercise 14 Reciprocal and power functions

1. Evaluate $1/1.75$ correct to 3 decimal places.
2. Evaluate $1/0.0250$
3. Evaluate $1/7.43$ correct to 5 significant figures.
4. Evaluate $1/0.00725$ correct to 1 decimal place.
5. Evaluate $(1/0.065) - (12.341)$ correct to 4 significant figures.
6. Evaluate 2.1^4
7. Evaluate $(0.22)^5$ correct to 5 significant figures in engineering form.
8. Evaluate $(1.012)^7$ correct to 4 decimal places.
9. Evaluate $(0.05)^6$ in engineering form.
10. Evaluate $1.1^3 + 2.9^4 - 4.4^2$ correct to 4 significant figures.

Root and $\times 10^x$ functions

Locate the square root function $\sqrt{\quad}$ and the $\sqrt[\square]{\quad}$ function (which is a Shift function located above the x^{\square} function) on your calculator. Also, locate the $\times 10^x$ function and then check the following worked examples.

Problem 9. Evaluate $\sqrt{361}$.

- (i) Press the $\sqrt{\quad}$ function.
- (ii) Type in 361 and $\sqrt{361}$ appears on the screen.
- (iii) Press = and the answer 19 appears. Thus, $\sqrt{361} = 19$

Problem 10. Evaluate $\sqrt[4]{81}$

- (i) Press the $\sqrt[\square]{\quad}$ function.
- (ii) Type in 4 and $\sqrt[4]{\quad}$ appears on the screen.
- (iii) Press \rightarrow to move the cursor and then type in 81 and $\sqrt[4]{81}$ appears on the screen.
- (iv) Press = and the answer 3 appears. Thus, $\sqrt[4]{81} = 3$.

Problem 11. Evaluate $6 \times 10^5 \times 2 \times 10^{-7}$

(i) Type in 6

(ii) Press the $\times 10^x$ function (note, you do not have to use \times).

(iii) Type in 5

(iv) Press \times

(v) Type in 2

(vi) Press the $\times 10^x$ function.

(vii) Type in -7

(viii) Press = and the answer $\frac{3}{25}$ appears.

(ix) Press the $S \Leftrightarrow D$ function and the fraction changes to a decimal: 0.12 Thus, $6 \times 10^5 \times 2 \times 10^{-7} = 0.12$

Now try the following Practice Exercise

Practice Exercise Root and $\times 10^x$ functions

1. Evaluate $\sqrt{4.76}$ correct to 3 decimal places.
2. Evaluate $\sqrt{123.7}$ correct to 5 significant figures.
3. Evaluate $\sqrt{34528}$ correct to 2 decimal places.
4. Evaluate $\sqrt{0.69}$ correct to 4 significant figures.
5. Evaluate $\sqrt{0.025}$ correct to 4 decimal places.
6. Evaluate $\sqrt[3]{17}$ correct to 3 decimal places.
7. Evaluate $\sqrt[4]{773}$ correct to 4 significant figures.
8. Evaluate $\sqrt[5]{3.12}$ correct to 4 decimal places.
9. Evaluate $\sqrt[3]{0.028}$ correct to 5 significant figures.
10. Evaluate $\sqrt[6]{2451} - \sqrt[4]{46}$ correct to 3 decimal places.

Express the answers to Problems 11 to 15 in engineering form.

11. Evaluate $5 \times 10^{-3} \times 7 \times 10^8$.

12. Evaluate $\frac{3 \times 10^{-4}}{8 \times 10^{-9}}$.

13. Evaluate $\frac{6 \times 10^3 \times 14 \times 10^{-4}}{2 \times 10^6}$

14. Evaluate $\frac{56.43 \times 10^{-3} \times 3 \times 10^4}{8.349 \times 10^3}$ correct to 3 decimal places

15. Evaluate $\frac{99 \times 10^5 \times 6.7 \times 10^{-3}}{36.2 \times 10^{-4}}$ correct to 4 significant figures.

Fractions

Locate the $\frac{\square}{\square}$ and $\square \frac{\square}{\square}$ functions on your calculator (the latter function is a Shift function found above the function $\frac{\square}{\square}$) and then check the following worked examples.

Problem 14. Evaluate $\frac{1}{4} + \frac{2}{3} = \frac{11}{12}$ $S \Leftrightarrow D \rightarrow 0.9166666\dots = 0.9167$ correct to 4 decimal places

Problem 15. Evaluate $5\frac{1}{5} - 3\frac{3}{4} = \frac{29}{20}$ $S \Leftrightarrow D \rightarrow 1.45$

Practice

Evaluate $\frac{\left(4\frac{1}{5} - 1\frac{2}{3}\right)}{\left(3\frac{1}{4} \times 2\frac{3}{5}\right)} - \frac{2}{9}$, as a decimal correct to 3 significant figures

Trigonometric functions

There are three functions on your calculator that are involved with trigonometry.

sin which is an abbreviation of **sine**

cos which is an abbreviation of **cosine**, and

tan which is an abbreviation of **tangent**

There are two main ways that angles are measured, i.e. in **degrees** or in **radians**. Pressing Shift, Setup and 3 shows degrees, and Shift, Setup and 4 shows radians. Press 3 and your calculator will be in **degrees mode**, indicated by a small D appearing at the top of the screen.

Problem 14. Evaluate $\sin 38^\circ$

(i) Make sure your calculator is in degrees mode.

(ii) Press sin function and sin(appears on the screen.

(iii) Type in 38 and close the bracket with) and sin (38) appears on the screen.

(iv) Press = and the answer 0.615661475... appears.

Thus, $\sin 38^\circ = 0.6157$, correct to 4 decimal places.

Problem 15. Evaluate $5.3 \tan (2.23 \text{ rad})$

- (i) Make sure your calculator is in radian mode by pressing Shift then Setup then 4 (a small R appears at the top of the screen).
- (ii) Type in 5.3 then press tan function and 5.3 tan(appears on the screen.
- (iii) Type in 2.23 and close the bracket with) and 5.3 tan (2.23) appears on the screen.
- (iv) Press = and the answer -6.84021262... appears.

Thus, $5.3 \tan(2.23 \text{ rad}) = -6.8402$, correct to 4 decimal places.

Practice

1. Evaluate $\tan 39.55^\circ - \sin 52.53^\circ$
2. Evaluate $\sin(0.437 \text{ rad})$
3. Evaluate $\frac{(\sin 42.6^\circ)(\tan 83.2^\circ)}{\cos 13.8^\circ}$

π and e^x functions

Press Shift and then press the $\times 10^x$ function key and π appears on the screen. Either press Shift and = (or = and $S \leftrightarrow D$) and the value of π appears in decimal form as 3.14159265...

Press Shift and then press the ln function key and e appears on the screen.

Enter 1 and then press = and $e^1 = e = 2.71828182...$

Now check the following worked examples involving π and e^x functions.

Problem 16. Evaluate 3.57π

(i) Enter 3.57

(ii) Press Shift and the $\times 10^x$ key and 3.57π appears on the screen.

(iii) Either press Shift and = (or = and $S \leftrightarrow D$) and the value of 3.57π appears in decimal form as 11.2154857...

Hence, $3.57\pi = 11.22$, correct to 4 significant figures.

Problem 17. Evaluate $e^{2.37}$

(i) Press Shift and then press the ln function key and e appears on the screen.

(ii) Enter 2.37 and $e^{2.37}$ appears on the screen.

(iii) Press Shift and = (or = and $S \leftrightarrow D$) and the value of $e^{2.37}$ appears in decimal form as 10.6973922...

Hence, $e^{2.37} = 10.70$, correct to 4 significant figures.

Errors and approximations

Error due to measurement:

all problems in which the measurement of distance, time, mass or other quantities occurs, an exact answer cannot be given; only an answer that is correct to a stated degree of accuracy can be given.

To take account of measurement errors it is usual to limit answers so that the result given is **not more than one significant figure greater than the least accurate number given in the data.**

Problem 18. The area A of a triangle is $A = \frac{1}{2} \times b \times h$. The base b when measured is found to be 3.26 cm, and the perpendicular height h is 7.5 cm. Determine the area of the triangle.

$$A = \frac{1}{2} \times 3.26 \times 7.5 = 12.225 \text{ cm}^2 \text{ (by calculator)}$$

$$\text{The approximate value is } \frac{1}{2} \times 3 \times 8 = 12 \text{ cm}^2$$

so there are no obvious blunder or magnitude errors. However, it is not usual in a measurement-type problem to state the answer to accuracy greater than 1 significant figure more than the least accurate number in the data; this is 7.5 cm, so the result should not have more than 3 significant figures.

Thus, **area of triangle = 12.2 cm²**

الأخطاء والتقريبات:

أخطاء دقة القياسات:

إن قياسات المسافات، الزمن، الكتل أو غيرها، محدودة الدقة. لذا فإن الحسابات الناتجة عنها تقريبية ويكتفى بعدد من الأرقام ذات الدلالة تزيد برقم واحد عن عدد الأرقام ذات الدلالة الأصغر في القياسات.

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Rounding-off errors:

can exist with decimal fractions. For example, to state that $\pi = 3.142$ is not strictly correct, but correct to 4 significant figures' is a true statement. (Actually, $\pi = 3.141592653589\dots$)

خطأ التدوير: وهو خطأ بسيط ينتج عن سوء تقريب الأرقام الأخيرة في الكسور العشرية.

Blunder errors

It is possible, through an incorrect procedure, to obtain the wrong answer to a calculation.

الخطأ الصريح: وينتج عن عمليات حسابية غير صحيحة.

Order of magnitude error

It exist if incorrect positioning of the decimal point occurs after a calculation has been completed.

خطأ المرتبة العشرية: ويحصل عندما تزاح الفاصلة العشرية عن موقعها أثناء أو بعد اتمام الحسابات.

Problem 19. State which type of error has been made in the following statements:

(a) $72 \times 31.429 = 2262.8$

خطأ تدوير

(b) $16 \times 0.08 \times 7 = 89.6$

خطأ المرتبة العشرية

(c) $11.714 \times 0.0088 = 0.3247$, correct to 4 decimal places

خطأ صريح

(d) $\frac{29.74 \times 0.0512}{11.89} = 0.12$, correct to 2 significant figures

خطأ تدوير

Calculator Practice revision

Use your calculator to

1. Evaluate $\cos 63.74^\circ$ correct to 4 decimal places
2. Evaluate $\tan 39.55^\circ - \sin 52.53^\circ$ correct to 3 decimal places
3. Evaluate $\sin(0.437 \text{ rad})$ correct to 4 decimal places
4. Evaluate $\frac{\sin 67^\circ - \sin 43^\circ}{\sin 10^\circ}$ correct to 3 decimal places

Use your calculator to

1. Evaluate $2.7(\pi - 1)$ correct to 3 significant figures
2. Evaluate $\pi^2(\sqrt{13} - 1)$ correct to 4 significant figures
3. Evaluate $3e^{(2\pi-1)}$ correct to 3 significant figures
4. Evaluate $\sqrt{\left[\frac{5.52\pi}{2e^{-2} \times \sqrt{26.73}}\right]}$ correct to 4 significant figures