Example 3 | **Self Tutor**

Simplify, giving answers in simplest rational form:

a 7^0 **b** 3^{-2} **c** $3^0 - 3^{-1}$ **d** $\left(\frac{5}{3}\right)^{-2}$

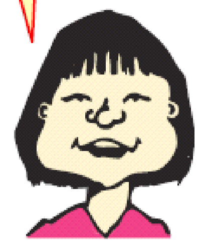
a $7^0 = 1$

b $3^{-2} = \dfrac{1}{3^2} = \frac{1}{9}$

c $3^0 - 3^{-1} = 1 - \frac{1}{3} = \frac{2}{3}$

d $\left(\frac{5}{3}\right)^{-2} = \left(\frac{3}{5}\right)^2 = \frac{9}{25}$

Notice that $\left(\dfrac{a}{b}\right)^{-2} = \left(\dfrac{b}{a}\right)^2$



Questions A

Saturday, 12 August 2017 3:27 PM

1 Which of the following numbers are *not* written in scientific notation?

a 3.7×10^4 b 4.2×10^{-7} c 0.3×10^5 d 21×10^{11}

2 Copy and complete:

$$
\begin{aligned}
1000 &= 10^3 \\
100 &= 10^2 \\
10 &= \\
1 &= \\
0.1 &= \\
0.01 &= 10^{-2} \\
0.001 &= \\
0.0001 &=
\end{aligned}
$$

3 Write as decimal numbers:

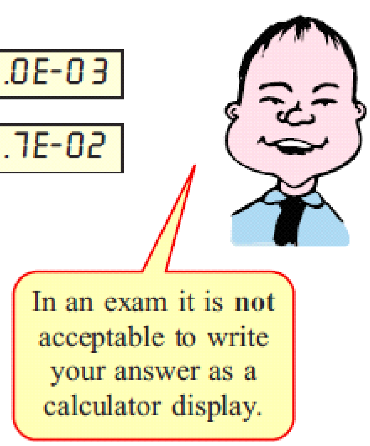
a 8.2×10^4 b 3.6×10^1 c 8.7×10^0 d 4.9×10^2
e 7.8×10^{-3} f 5.5×10^{-2} g 3.76×10^{-1} h 2.02×10^{-3}

4 Write in scientific notation:

a 3900 b 17000 c 0.04 d 0.000 071
e 85 f 6.3 g 2 480 000 h 0.000 000 108

5 Write these calculator displays in scientific notation:

a `4.5E07` b `3.8E-04` c `2.1E05` d `4.0E-03`
e `6.1E03` f `1.6E-06` g `3.9E04` h `6.7E-02`



6 Write the numbers displayed in question **5** as decimal numbers.

For example, `3.9E06` is 3.9×10^6

$$
\begin{aligned}
&= 3.900\,000 \times 1\,000\,000 \\
&= 3\,900\,000
\end{aligned}
$$

7 Use your calculator to evaluate the following, giving your answer in scientific notation:

a $680\,000 \times 73\,000\,000$ b 900^4 c $0.0006 \div 15\,000$
d $(0.0007)^3$ e $5.3 \times 10^8 \times 6.4 \times 10^5$ f $2.6 \times 10^4 \times 3.7 \times 10^{-9}$
g $\dfrac{3.6 \times 10^4}{7.5 \times 10^{11}}$ h $\dfrac{4.9 \times 10^{-5}}{1.12 \times 10^6}$

Questions B

Saturday, 12 August 2017 3:24 PM

1 Solve for x:

a $3^x = 3$ **b** $3^x = 9$ **c** $2^x = 8$ **d** $5^x = 1$

e $3^x = \frac{1}{3}$ **f** $5^x = \frac{1}{5}$ **g** $2^x = \frac{1}{16}$ **h** $5^{x+2} = 25$

i $2^{x+2} = \frac{1}{4}$ **j** $3^{x-1} = \frac{1}{27}$ **k** $2^{x-1} = 32$ **l** $3^{1-2x} = \frac{1}{27}$

m $4^{2x+1} = \frac{1}{2}$ **n** $9^{x-3} = 3$ **o** $(\frac{1}{2})^{x-1} = 2$ **p** $(\frac{1}{3})^{2-x} = 9$

2 Solve for x:

a $5 \times 2^x = 40$ **b** $6 \times 2^{x+2} = 24$ **c** $3 \times (\frac{1}{2})^x = 12$

d $4 \times 5^x = 500$ **e** $8 \times (\frac{1}{2})^x = 1$ **f** $7 \times (\frac{1}{3})^x = 63$

g $2^{2-5x} = 4^x$ **h** $5^{x-1} = (\frac{1}{25})^x$ **i** $9^{x-2} = (\frac{1}{3})^{3x-1}$

j $2^x \times 4^{2-x} = 8$ **k** $3^{x+1} \times 9^{-x} = (\frac{1}{3})^{x+1}$ **l** $2^{x^2-2x} = 8$

$$2^{x^2-2x} = 8$$
$$2^{x^2-2x} = 2^3$$
$$x^2-2x = 3$$
$$x^2-2x-3 = 0$$
$$(x+1)(x-3) = 0$$
$$x = -1 \quad x = 3$$

1 **a** $x = 1$ **b** $x = 2$ **c** $x = 3$ **d** $x = 0$
e $x = -1$ **f** $x = -1$ **g** $x = -4$ **h** $x = 0$
i $x = -4$ **j** $x = -2$ **k** $x = 6$ **l** $x = 2$
m $x = -\frac{3}{4}$ **n** $x = \frac{7}{2}$ **o** $x = 0$ **p** $x = 4$

2 **a** $x = 3$ **b** $x = 0$ **c** $x = -2$ **d** $x = 3$
e $x = 3$ **f** $x = -2$ **g** $x = \frac{2}{7}$ **h** $x = \frac{1}{3}$
i $x = 1$ **j** $x = 1$ **k** no solution **l** $x = 3$ or -1

(8) $(x+1)(x+2)(x+3)$

$(x+1)(x^2+5x+6)$

$x^3+5x^2+6x+x^2+5x+6$

$x^3+6x^2+11x+6$

Further Expansion

Sunday, 13 August 2017 1:14 PM

In this section we expand more complicated expressions by repeated use of the expansion laws.

Consider the expansion of $(a+b)(c+d+e)$.

Now $\quad (a+b)(c+d+e)$
$= (a+b)c + (a+b)d + (a+b)e$
$= ac + bc + ad + bd + ae + be$

Compare: $\quad \square(c+d+e)$
$= \square c + \square d + \square e$

Notice that there are 6 terms in this expansion and that each term within the first bracket is multiplied by each term in the second.

2 terms in first bracket $\times$ 3 terms in second bracket $\longrightarrow$ 6 terms in expansion.

Example 8 **Self Tutor**

Expand and simplify: $(x+3)(x^2+2x+4)$

$(x+3)(x^2+2x+4)$
$= x^3 + 2x^2 + 4x$ {all terms of 2nd bracket $\times\ x$}
$\quad + 3x^2 + 6x + 12$ {all terms of 2nd bracket $\times\ 3$}
$= x^3 + 5x^2 + 10x + 12$ {collecting like terms}

Example 9 **Self Tutor**

Expand and simplify:

a $x(x+1)(x+3)$ **b** $(x+1)(x-3)(x+2)$

a $x(x+1)(x+3)$
$= (x^2+x)(x+3)$ {all terms in first bracket $\times\ x$}
$= x^3 + 3x^2 + x^2 + 3x$ {expand remaining factors}
$= x^3 + 4x^2 + 3x$ {collect like terms}

b $(x+1)(x-3)(x+2)$
$= (x^2 - 3x + x - 3)(x+2)$ {expand first two factors}
$= (x^2 - 2x - 3)(x+2)$ {collect like terms}
$= x^3 - 2x^2 - 3x + 2x^2 - 4x - 6$ {expand remaining factors}
$= x^3 - 7x - 6$ {collect like terms}

⑥ $\left(x - \frac{1}{2}\right)^4$

⑦ $\left(\frac{x}{2} - \frac{1}{3}\right)^5$

⑧ $(a+b)^n$

Extension

Friday, 18 August 2017 6:30 AM

5. Find the coefficient of x^{-3} in the expansion of $(x-1)^3\left(\frac{1}{x}+x\right)^6$.

6. Find the constant term in the expansion of $\left(x-\frac{1}{2x}\right)^{10}$.

7. Find the constant term in the expansion of $\left(3x-\frac{1}{6x}\right)^{12}$.

8. Find the term independent of x in the expansion of $(2-x)^3\left(\frac{1}{3x}-x\right)^6$.

9. Find the term independent of x in the expansion of $\left(2x-\frac{1}{x}\right)^6\left(\frac{1}{2x}+x\right)^6$.

5. 19 **6.** $-\frac{63}{8}$ **7.** $\frac{231}{16}$ **8.** $-\frac{130}{27}$ **9.** -20

(4) $x^2 - 7x + 12$

$(x - 3)(x - 4)$

(5) $3x^2 + 14x - 5$

$(3x - 1)(x + 5)$

(6) $2x^2 - 5x - 12$

$(2x + 3)(x - 4)$

check

$2x^2 - 8x + 3x - 12$

$2x^2 - 5x - 12$ ✓

Levels 5/6

1 5 10 10 5 1

13. Expand and fully simplify using the Binomial Expansion:

$$\left(\frac{x^2}{2}-\frac{1}{x}\right)^5$$

$$\left(\frac{x^2}{2}\right)^5+5.\left(\frac{x^2}{2}\right)^4.\left(-\frac{1}{x}\right)+10.\left(\frac{x^2}{2}\right)^3.\left(-\frac{1}{x}\right)^2+10.\left(\frac{x^2}{2}\right)^2\left(-\frac{1}{x}\right)^3+5.\left(\frac{x^2}{2}\right)^1\left(-\frac{1}{x}\right)^4+\left(\frac{-1}{x}\right)^5$$

$$=\frac{x^{10}}{32}-\frac{5x^8}{16x}+\frac{10x^6}{8x^2}-\frac{10x^4}{4x^3}+\frac{5x^2}{2x^4}-\frac{1}{x^5}$$

$$=\frac{x^{10}}{32}-\frac{5x^7}{16}+\frac{5}{4}x^4-\frac{5}{2}x+\frac{5}{2x^2}-\frac{1}{x^5}$$

14. Simplify $\frac{n!}{(n-2)!}$ $\quad n(n-1)$

15. Simplify the following:

$$\frac{x^2-5x+6}{2x^2-5x-3}$$

error corrected during test (extra time given)

$$\frac{\cancel{(x-3)}(x-2)}{(2x+1)\cancel{(x-3)}}$$

$$=\frac{x-2}{2x+1}$$

16. Find the constant term in the expansion of the following. Simplify your answer as far as possible.

$$\left(3x^2+\frac{1}{x^2}\right)^8$$

*

$${}^nC_r\, a^{n-r} b^r$$

$${}^8C_r\,.(3x^2)^{8-r}.\left(\frac{1}{x^2}\right)^r \qquad x^{16-2r-2r}$$

$$r=4$$

$${}^8C_4\,.3^4$$

$$=\frac{\cancel{8}.7.\cancel{6}.5}{\cancel{4}.\cancel{3}.\cancel{2}.1}\times 81 = 70\times 81$$

81
× 70
5670

5670

Level 7

17. Fully factorise the following:

$$25^x+2\times5^x-3$$

$$(5^x-1)(5^x+3)$$

$$5^x.5^x+3.5^x-5^x-3$$

$$(5^x)^2+2.5^x-3$$

18. Factorise $27-8x^3$

$$=8(27-x^3)$$

$$=8(3-x)(3^2+3x+x^2)$$

$$=8(3-x)(9+3x+x^2)$$

$$x^2\times x^3=x^5$$

19 Solve the following for x

$$(x^2+x-57)^{3x^2+3}=(x^2+x-57)^{10x}$$

(e) $3, 7, \frac{-1\pm\sqrt{233}}{2}, \frac{1}{3}$

$$3x^2+3=10x$$

$$3x^2-10x+3=0$$

$$(3x-1)(x-3)=0$$

$$x=\frac{1}{3} \qquad x=3$$

$$x^2+x-57=1$$

$$x^2+x-58=0$$

$$x=\frac{-1\pm\sqrt{1-4.1.-58}}{2}$$

$$=\frac{-1\pm\sqrt{233}}{2}$$

also try

$$x^2+x-57=-1$$

$$x^2+x-56=0$$

$$x=\frac{-1\pm\sqrt{1-4.1.-56}}{2}=\frac{-1\pm\sqrt{225}}{2}$$

$$=\frac{-1\pm15}{2}$$

7 yes or −8 ×

20 Find the coefficient of x^6 in the expansion of $(2-x)(3x+1)^9$. Simplify your answer.

$${}^9C_r\,(3x)^{9-r}.1^r$$

$$9-r=5 \qquad r=4$$

$${}^9C_4\,.3^5\times -1$$

also

$$9-r=6 \qquad r=3$$

$${}^9C_3\,.3^6\times 2$$

$$2\,{}^9C_3\,3^6-{}^9C_4\,3^5$$

$$=91854$$

Example 11

Self Tutor

Expand and simplify:

a $(\sqrt{3}+2)^2$

b $(\sqrt{3}-\sqrt{7})^2$

a
$$\begin{aligned}&(\sqrt{3}+2)^2\\ &= (\sqrt{3})^2 \;+\; 2\times\sqrt{3}\times 2 \;+\; 2^2\\ &= 3+4\sqrt{3}+4\\ &= 7+4\sqrt{3}\end{aligned}$$

b
$$\begin{aligned}&(\sqrt{3}-\sqrt{7})^2\\ &= (\sqrt{3})^2 \;+\; 2\times\sqrt{3}\times(-\sqrt{7}) \;+\; (-\sqrt{7})^2\\ &= 3-2\sqrt{21}+7\\ &= 10-2\sqrt{21}\end{aligned}$$

Example 12

Self Tutor

Expand and simplify:

a $(3+\sqrt{2})(3-\sqrt{2})$

b $(2\sqrt{3}-5)(2\sqrt{3}+5)$

a
$$\begin{aligned}&(3+\sqrt{2})(3-\sqrt{2})\\ &= 3^2-(\sqrt{2})^2\\ &= 9-2\\ &= 7\end{aligned}$$

b
$$\begin{aligned}&(2\sqrt{3}-5)(2\sqrt{3}+5)\\ &= (2\sqrt{3})^2-5^2\\ &= (4\times 3)-25\\ &= 12-25\\ &= -13\end{aligned}$$

Exercise 4F - Equality of Surds

Sunday, 27 August 2017 12:47 PM

1 Solve for x and y given that they are rational:

- **a** $x + y\sqrt{2} = 3 + 2\sqrt{2}$
- **b** $15 - 4\sqrt{2} = x + y\sqrt{2}$
- **c** $-x + y\sqrt{2} = 11 - 3\sqrt{2}$
- **d** $x + y\sqrt{2} = 6$
- **e** $x + y\sqrt{2} = -3\sqrt{2}$
- **f** $x + y\sqrt{2} = 0$

2 Solve for x and y given that they are rational:

- **a** $(x + y\sqrt{2})(2 - \sqrt{2}) = 1 + \sqrt{2}$
- **b** $(x + y\sqrt{2})(3 + \sqrt{2}) = 1$
- **c** $(2 - 3\sqrt{2})(x + y\sqrt{2}) = \sqrt{2}$
- **d** $(x + y\sqrt{2})(3 - \sqrt{2}) = -4\sqrt{2}$

3 Find rationals a and b such that:

- **a** $(a + \sqrt{2})(2 - \sqrt{2}) = 4 - b\sqrt{2}$
- **b** $(a + 3\sqrt{2})(3 - \sqrt{2}) = 6 + b\sqrt{2}$
- **c** $(a + b\sqrt{2})^2 = 33 + 20\sqrt{2}$
- **d** $(a + b\sqrt{2})^2 = 41 - 24\sqrt{2}$

4 Find $\sqrt{11 - 6\sqrt{2}}$. **Hint:** $\sqrt{2}$ is never negative.

5
- **a** Write $\sqrt{11 + 4\sqrt{6}}$ in the form $a\sqrt{2} + b\sqrt{3}$ where $a, b \in \mathbb{Q}$.
- **b** Can $\sqrt{11 + 4\sqrt{6}}$ be written in the form $a + b\sqrt{6}$ where $a, b \in \mathbb{Q}$? Explain your answer.

2c

$$(2 - 3\sqrt{2})(x + y\sqrt{2}) = \sqrt{2}$$

$$2x + 2y\sqrt{2} - 3\sqrt{2}x - 6y = \sqrt{2}$$

$2x - 6y = 0$ $\qquad$ $2y - 3x = 1$

$x - 3y = 0$ $\qquad$ $2y - 3(3y) = 1$

$x = 3y$ $\qquad$ $2y - 9y = 1$

$-7y = 1$

$\boxed{x = -\frac{3}{7}}$ $\qquad$ $\boxed{y = -\frac{1}{7}}$

1
- **a** $x = 3,\ y = 2$
- **b** $x = 15,\ y = -4$
- **c** $x = -11,\ y = -3$
- **d** $x = 6,\ y = 0$
- **e** $x = 0,\ y = -3$
- **f** $x = y = 0$

2
- **a** $x = 2,\ y = \frac{3}{2}$
- **b** $x = \frac{3}{7},\ y = -\frac{1}{7}$
- **c** $x = -\frac{3}{7},\ y = -\frac{1}{7}$
- **d** $x = -\frac{8}{7},\ y = -\frac{12}{7}$

3
- **a** $a = 3,\ b = 1$
- **b** $a = 4,\ b = 5$
- **c** $a = 5,\ b = 2$ or $a = -5,\ b = -2$
- **d** $a = 3,\ b = -4$ or $a = -3,\ b = 4$

4 Let $\sqrt{11 - 6\sqrt{2}} = a + b\sqrt{2};\ \ a, b \in \mathbb{Q}$

Show $a + b\sqrt{2} = 3 - \sqrt{2}$ or $-3 + \sqrt{2}$

But $11 - 6\sqrt{2} > 0$

$\therefore\ \sqrt{11 - 6\sqrt{2}} = 3 - \sqrt{2}$

5
- **a** $\sqrt{11 + 4\sqrt{6}} = 2\sqrt{2} + \sqrt{3}$
- **b** No. (Suppose it can and see what happens.)

Ex4E Q4 and Q6

Tuesday, 29 August 2017 6:12 PM

4a) $\frac{1+\sqrt{2}}{1-\sqrt{2}} + \frac{1-\sqrt{2}}{1+\sqrt{2}}$

make into a single fraction

$\frac{(1+\sqrt{2})(1+\sqrt{2})}{(1-\sqrt{2})(1+\sqrt{2})} + \frac{(1-\sqrt{2})(1-\sqrt{2})}{(1+\sqrt{2})(1-\sqrt{2})}$

$= \frac{(1+\sqrt{2})^2 + (1-\sqrt{2})^2}{(1-\sqrt{2})(1+\sqrt{2})}$

$= \frac{1+\cancel{2\sqrt{2}}+2+1-\cancel{2\sqrt{2}}+2)}{-1}$

$= -6$

now try another one

6) $\sqrt{\frac{3+2\sqrt{2}}{3-2\sqrt{2}}} = \sqrt{\frac{3+2\sqrt{2}}{3-2\sqrt{2}} \times \frac{3+2\sqrt{2}}{3+2\sqrt{2}}}$

$= \sqrt{\frac{(3+2\sqrt{2})^2}{9-8}}$

$= \sqrt{\frac{(3+2\sqrt{2})^2}{1}}$

$= \underline{3+2\sqrt{2}}$

Solving Examples

Friday, 01 September 2017 8:18 AM

Solving Examples

① Solve

Linear

1 answer

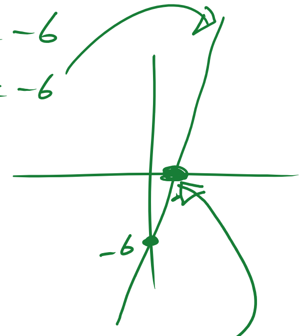
$f(x) = 2x - 6$

$y = 2x - 6$

$2x - 6 = 0$

$2x = 6$

$\underline{x = 3}$



② Solve

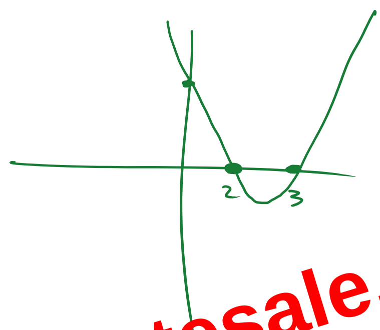
Quadratic

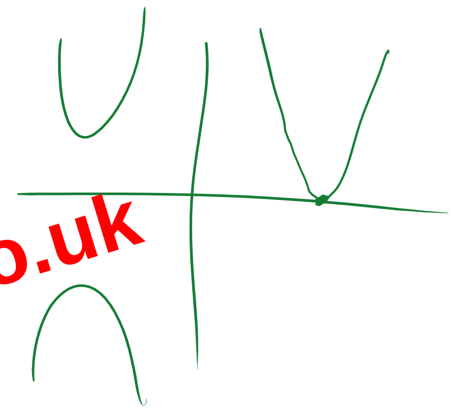
$x^2 - 5x + 6 = 0$

$(x - 3)(x - 2) = 0$

$x - 3 = 0$ or $x - 2 = 0$

$\underline{x = 3}$ $\underline{x = 2}$





③ Solve

Quadratic

$2x^2 - 5x + 2 = 0$

$(2x - 1)(x - 2) = 0$

$2x - 1 = 0$ $\underline{x = 2}$

$2x = 1$

$\underline{x = \frac{1}{2}}$

9b

$3x^4 - 24x^3 + 48x^2 = 0$

$3x^2(x^2 - 8x + 16) = 0$

$3x^2 = 0$ $\quad$ $(x-4)^2 = 0$

$x^2 = 0$ $\quad$ $x = 4$

$x = 0$

9c

$2x^6 + 88x^2 = 30x^4$

$2x^6 - 30x^4 + 88x^2 = 0$

$2x^2(x^4 - 15x^2 + 44) = 0$

$2x^2 = 0$ $\quad$ $(x^2 - 11)(x^2 - 4) = 0$

$x^2 = 0$ $\quad$ $x^2 = 11$ $\quad$ $x^2 = 4$

$x = 0$ $\quad$ $x = \pm\sqrt{11}$ $\quad$ $x = \pm 2$

10a

$\sqrt{x+2} = x$

$x + 2 = x^2$

$0 = x^2 - x - 2$

$0 = (x+1)(x-2)$

$x = -1$ $\quad$ $x = 2$

check answers for validity

$\sqrt{-1+2} = -1$? $\quad$ $\sqrt{2+2} = 2$?

$\sqrt{1} = -1$? $\quad$ $\sqrt{4} = 2$?

this means $\quad$ yes

$+\sqrt{1} = -1$? $\quad$ $x = 2$ only

no, so invalid

10b

$\sqrt{x+13} - \sqrt{7-x} = 2$

$\sqrt{x+13} = 2 + \sqrt{7-x}$

$x + 13 = (2 + \sqrt{7-x})^2$

$x + 13 = 4 + 4\sqrt{7-x} + 7 - x$

$0 = 4\sqrt{7-x} - 2 - 2x$

$2 + 2x = 4\sqrt{7-x}$

$4 + 8x + 4x^2 = 16(7-x)$

$4 + 8x + 4x^2 = 112 - 16x$

$4x^2 + 24x - 108 = 0$

$x^2 + 6x - 27 = 0$

$(x-3)(x+9) = 0$

$x = 3$ $\quad$ $x = -9$

does not work when 'plugged' back in

invalid answer

The faces

Thursday, 07 September 2017 2:14 PM

Mahnur's Ms Shalisa

Lydia's Herman the Tourist Sloth

Yuta's no name

Ayesha's sad face

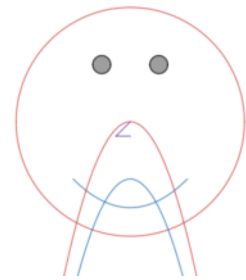
Alec's Sipho the happy g

Felix's ya boi

Caleb's lloys

Catharina's pointy head

Seung kwon's mr forehead



Rodrigo's smiley face

ngh x axis

tch by factor a

3Adv Lesson 12: Advanced Quadratics

Friday, 15 September 2017 8:24 AM

B: Sum and Product of Roots

Friday, 15 September 2017 8:29 AM

If $ax^2 + bx + c = 0$ has roots α and β, then $\alpha + \beta = -\dfrac{b}{a}$ and $\alpha\beta = \dfrac{c}{a}$.

For example: If α and β are the roots of $2x^2 - 2x - 1 = 0$
then $\alpha + \beta = 1$ and $\alpha\beta = -\frac{1}{2}$.

Proof: If α and β are the roots of $ax^2 + bx + c = 0$,
then

$$\begin{aligned} ax^2 + bx + c &= a(x-\alpha)(x-\beta) \\ &= a(x^2 - [\alpha+\beta]x + \alpha\beta) \end{aligned}$$

$$\therefore \quad x^2 + \frac{b}{a}x + \frac{c}{a} = x^2 - [\alpha+\beta]x + \alpha\beta$$

Equating coefficients,

$$\alpha + \beta = -\frac{b}{a} \quad \text{and} \quad \alpha\beta = \frac{c}{a}.$$

Example 11 **Self Tutor**

Find the sum and product of the roots of $25x^2 - 20x + 1 = 0$.
Check your answer by solving the quadratic.

If α and β are the roots then $\alpha + \beta = -\dfrac{b}{a} = \dfrac{20}{25} = \dfrac{4}{5}$

and $\alpha\beta = \dfrac{c}{a} = \dfrac{1}{25}$

Check: $25x^2 - 20x + 1 = 0$ has roots

$$\frac{20 \pm \sqrt{400 - 4(25)(1)}}{50} = \frac{20 \pm \sqrt{300}}{50} = \frac{20 \pm 10\sqrt{3}}{50} = \frac{2 \pm \sqrt{3}}{5}$$

These have sum $= \dfrac{2+\sqrt{3}}{5} + \dfrac{2-\sqrt{3}}{5} = \dfrac{4}{5}$ ✓

and product $= \left(\dfrac{2+\sqrt{3}}{5}\right)\left(\dfrac{2-\sqrt{3}}{5}\right) = \dfrac{4-3}{25} = \dfrac{1}{25}$ ✓

Extension Questions

Friday, 15 September 2017 8:31 AM

2 The equation $kx^2 - (1+k)x + (3k+2) = 0$ is such that the sum of its roots is twice their product. Find k and the two roots.

3 The quadratic equation $ax^2 - 6x + a - 2 = 0$, $a \neq 0$, has one root which is double the other.

a Let the roots be α and 2α. Hence find two equations involving α.

b Find a and the two roots of the quadratic equation.

4 The quadratic equation $kx^2 + (k-8)x + (1-k) = 0$, $k \neq 0$, has one root which is two more than the other. Find k and the two roots.

2 $k = -\frac{3}{5}$, roots are -1 and $\frac{1}{3}$

3 **a** $3\alpha = \dfrac{6}{a}$, $2\alpha^2 = \dfrac{a-2}{a}$

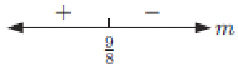
b $a = 4$, roots are $\frac{1}{2}$ and 1 or $a = -2$, roots are -1 and -2

4 $k = 4$, roots are $-\frac{1}{2}$ and $\frac{3}{2}$ or $k = 16$, roots are $-\frac{5}{4}$ and $\frac{3}{4}$

3 **a** $\Delta = 16 - 4m$

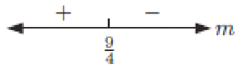
i $m = 4$ **ii** $m < 4$ **iii** $m > 4$

b $\Delta = 9 - 8m$



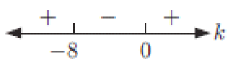
i $m = \frac{9}{8}$ **ii** $m < \frac{9}{8}$ **iii** $m > \frac{9}{8}$

c $\Delta = 9 - 4m$



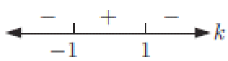
i $m = \frac{9}{4}$ **ii** $m < \frac{9}{4}$ **iii** $m > \frac{9}{4}$

4 **a** $\Delta = k^2 + 8k$



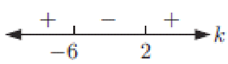
i $k < -8$ or $k > 0$ **ii** $k \leqslant -8$ or $k \geqslant 0$
iii $k = -8$ or 0 **iv** $-8 < k < 0$

b $\Delta = 4 - 4k^2$



i $-1 < k < 1$ **ii** $-1 \leqslant k \leqslant 1$
iii $k = \pm 1$ **iv** $k < -1$ or $k > 1$

c $\Delta = k^2 + 4k - 12$

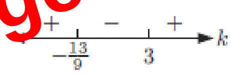


i $k < -6$ or $k > 2$ **ii** $k \leqslant -6$ or $k \geqslant 2$
iii $k = -6$ or 2 **iv** $-6 < k < 2$

d $\Delta = k^2 - 4k - 12$

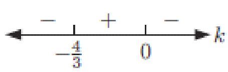
i $k < -2$ or $k > 6$ **ii** $k \leqslant -2$ or $k \geqslant 6$
iii $k = 6$ or -2 **iv** $-2 < k < 6$

e $\Delta = 9k^2 - 14k - 39$



i $k < -\frac{13}{9}$ or $k > 3$ **ii** $k \leqslant -\frac{13}{9}$ or $k \geqslant 3$
iii $k = -\frac{13}{9}$ or 3 **iv** $-\frac{13}{9} < k < 3$

f $\Delta = -3k^2 - 4k$



i $-\frac{4}{3} < k < 0$ **ii** $-\frac{4}{3} \leqslant k \leqslant 0$
iii $k = -\frac{4}{3}$ or 0 **iv** $k < -\frac{4}{3}$ or $k > 0$

3Adv Lesson 14 Division of Polynomials

Friday, 22 September 2017 6:58 AM

① Addition

$$(x^3+x^2-3x+5)+(2x^2-x-3)=x^3+3x^2-4x+2$$

② Subtraction

$$x^2+7x-2-(x^5-2x+1)=x^2+7x-2-x^5+2x-1$$
$$=-x^5+x^2+9x-3$$

③ Multiplication

④ Division ?