

Advanced Level Mathematics Preparatory Work 2014/15

Complete the missing numbers, *without* using a calculator.

(a) $3^? = \frac{1}{81}$

(b) $2^? = \frac{1}{2}$

(c) $5^? = \frac{1}{125}$

(d) $36^? = 6$

(e) $36^? = \frac{1}{6}$

(f) $7^? = 49$

(g) $7^? = 343$

(h) $17^? = \frac{1}{17}$

(i) $125^? = 5$

(j) $\frac{1}{2} = 2^?$

(k) $\frac{1}{4} = 2^?$

(l) $\frac{1}{100} = 10^?$

(m) $\frac{1}{a^3} = a^?$

(n) $\sqrt{m} = m^?$

(o) $\frac{1}{p^2} = p^?$

(p) $\sqrt[3]{q} = q^?$

(q) $\sqrt[3]{q^2} = q^?$

(r) $\sqrt[5]{q^2} = q^?$

Simplify the following expressions, so that they contain no negative indices.

(a) $a^6 \times a^{-7} =$

(b) $\frac{a^7}{a^{-3}} =$

(c) $\frac{a^{-5}}{a^{-9}} =$

(d) $a^{-4} \times a^{-2} =$

(e) $(a^2)^{-1} =$

(f) $(a^2)^{-3} =$

(g) $(a^{-2})^{-4} =$

(h) $(a^{\frac{1}{2}})^5 =$

(i) $(a^3)^{-\frac{1}{2}} =$

(j) $(a^6)^{\frac{1}{3}} =$

(k) $(a^9)^{-\frac{1}{3}} =$

(l) $(a^{-12})^{-\frac{1}{4}} =$

(m) $\left(\frac{a}{b}\right)^2 =$

(n) $(a^2 \times b^{-4})^3 =$

(o) $(a^3 b^{\frac{1}{2}})^4 =$

Make x the subject of each of the following formulae.

(a) $2x + a = x - b$

(b) $ax - b = cx - d$

(c) $xa - 4 = bx - 5$

(d) $3x - 6 = 4a + 2x$

(e) $b - 2x = c - 5x$

(f) $a - bx = c - dx$

Make x the subject of each of the following formulae.

(a) $P = \frac{x}{x+1}$

(b) $P = \frac{ax+b}{x}$

(c) $Q = \frac{x+b}{x-a}$

(d) $q^2 = \frac{x+y}{x-y}$

(e) $\frac{x-2}{x+3} = a$

(f) $\frac{x-b}{x-c} = 4$

(g) $p = \sqrt{\frac{x}{x+1}}$

(h) $w = \sqrt{\frac{x-2}{x}}$

(i) $w = \sqrt{\frac{x-2}{x+1}}$

Factorise each of the following using the difference of two squares result.

(a) $x^2 - 1$

(b) $x^2 - 16$

(c) $x^2 - 81$

(d) $9x^2 - 4$

(e) $16x^2 - 36$

(f) $4x^2 - 100$

Factorise each of the following expressions.

(a) $3x^2 - 2x - 1$

(b) $3x^2 + 4x + 1$

(c) $2x^2 + 5x + 2$

(d) $3x^2 + 8x + 4$

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

(f) $4x^2 - 11x - 3$

Use the quadratic equation formula to find the solutions, where they exist, of each of the following equations. Give answers to 2 decimal places.

(a) $4x^2 - 7x + 3 = 0$

(b) $2x^2 + x - 10 = 0$

(c) $9x^2 - 6x - 11 = 0$

Simplify each of the following expressions.

(d) $\frac{x^4 + 5x^2}{x(x+5)}$

(e) $\frac{x^3 - x^2}{x}$

(f) $\frac{x^6 - x^3}{x(x-1)}$

(g) $\frac{x^2 + x}{x^2 - 1}$

(h) $\frac{x^3 - 4x}{x^2 - 3x - 4}$

(i) $\frac{x^2 - 9}{x^2 + 4x + 3}$

Complete the square for each of the expressions below.

(a) $x^2 + 4x - 5$ (b) $x^2 + 6x - 1$ (c) $x^2 + 10x - 2$

Use the completing the square method to solve each of the following equations.

(a) $x^2 - 4x + 3 = 0$ (b) $x^2 - 6x - 4 = 0$ (c) $x^2 + 10x - 8 = 0$

Complete the square for each of the following expressions.

(a) $2x^2 + 8x - 1$ (b) $2x^2 + 10x - 3$ (c) $2x^2 + 2x + 1$

Solve each of the following equations.

1. $\frac{x}{x+4} + \frac{1}{x} = \frac{3}{4}$

2. $\frac{x}{x-2} - \frac{x}{x+2} = \frac{4}{3}$

3. $\frac{2x}{x+1} - \frac{x}{x+3} = \frac{25}{24}$

4. $\frac{x}{2x+1} + \frac{x}{x-1} = \frac{12}{5}$

Solve each pair of simultaneous equations.

(a) $x + 2y = 5$
 $3x + y = 5$

(b) $3x + 2y = 19$
 $x + 5y = 15$

(c) $x - 2y = 4$
 $4x + 3y = 49$

(d) $2x + 3y = 14$
 $5x + 2y = 24$

(e) $3x + 4y = 2$
 $7x - 5y = 9$

(f) $4x + 2y = 16$
 $-3x + 2y = -19$

For each triangle, write $\sin \theta$, $\cos \theta$ and $\tan \theta$ as fractions.

