MATHLETICS

Basic Arithmetic and Algebra

Student Book - Series L-2

Mathletics Instant Workbooks

Basic arithmetic and algebra
Student Book - Series L 2

Contents

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Basic arithmetic and algebra

Topic 1 - Numbers, fractions and decimals

QUESTION 1 Complete:

a An _____ is a whole number (positive, negative or zero).

b A _____ number is any number that can be expressed in the form $\frac{p}{q}$ where p and q are integers.

c An _____ number cannot be expressed in the form $\frac{p}{q}$

d The _____ is the top part of a fraction.

e The _____ is the bottom part of a fraction.

f An _____ fraction has its numerator greater than its denominator.

g The product of any fraction and its reciprocal is _____.

QUESTION 2 State whether each number is rational or irrational.

a 5 _____ **b** $\sqrt{5}$ _____ **c** $\frac{2}{3}$ _____ **d** $0.35\dot{8}$ _____

e π _____ **f** 7.12 _____ **g** 0 _____ **h** $\frac{22}{7}$ _____

QUESTION 3 Express each fraction in simplest form.

a $\frac{18}{36}$ = _____ **b** $6\frac{9}{12}$ = _____ **c** $\frac{15}{8}$ = _____ **d** $\frac{34}{4}$ = _____

QUESTION 4 Write down the reciprocal of:

a $\frac{1}{2}$ _____ **b** $\frac{4}{5}$ _____ **c** $1\frac{2}{3}$ _____ **d** 6 _____

QUESTION 5 Find, without a calculator.

a $1\frac{2}{3}+\frac{3}{5}$ = _____

_____

b $2-\frac{5}{7}$ = _____

_____

c $\frac{2}{3}\cdot\frac{4}{7}$ = _____

_____

d $\frac{3}{4}\div\frac{7}{8}$ = _____

_____

Basic arithmetic and algebra

Topic 2 - Conversions between fractions and decimals

QUESTION 1 Change these fractions to decimals.

a $\frac{4}{5}$ =

b $\frac{1}{8}$ =

c $\frac{17}{25}$ =

d $\frac{5}{9}$ =

e $\frac{6}{11}$ =

f $\frac{2}{7}$ =

QUESTION 2 Change these decimals to fractions in simplest form.

a 0.7 =

b 1.91=

c 0.067 =

d 0.24 =

e 2.35 =

f 15.425 =

QUESTION 3 Change these repeating decimals to fractions in simplest form.

a $0.\dot{8}$

b $0.\dot{6}\dot{4}$

c $0.\dot{3}\dot{4}\dot{5}$

d $1.\dot{5}\dot{6}$

e $0.8\dot{5}$

f $6.\dot{7}\dot{8}\dot{3}$

Basic arithmetic and algebra

Topic 3 - Percentages

Question 1 Write each percentage as a fraction in simplest form.

a 90% = _____ **b** 75% = _____ **c** 62.5% = _____ **d** 40% = _____

Question 2 Write each percentage as a decimal.

a 70% = _____ **b** 7% = _____ **c** $18\frac{1}{2}$% = _____ **d** 150% = _____

Question 3 Write as a percentage.

a $\frac{7}{8}$ = _____ **b** 0.0375 = _____ **c** $2\frac{1}{4}$ = _____ **d** 1.45 = _____

Question 4 Find:

a 3% of $9000

_____

_____

b 85% of 975 m

_____

_____

c 125% of $64

_____

_____

Question 5 What percentage is:

a 38 of 76?

_____

_____

b 20 g of 1 kg?

_____

_____

c 75 m of 2 km?

_____

_____

Question 6 Find 100% if:

a 15% is $2400

_____

_____

b 64% is 3248 m

_____

_____

c 95% is $1.90

_____

_____

Question 7 Solve these problems.

a A shirt is bought for $39.60 at a shop which is having a sale and is offering 12% off the marked price. What was the marked price?

_____

_____

_____

_____

b Hal is paid $150 per week plus a commission of 5% of that part of his sales which exceeds $2000. What is his weekly pay when his sales total $8500?

_____

_____

_____

_____

c Rachel bought a painting for $12 500 and sold it for $19 000. What was her profit as a percentage of the cost price?

_____

_____

_____

_____

_____

Basic arithmetic and algebra

Topic 4 - Scientific notation, significant figures and rounding off

Question 1 Express in scientific notation.

a 30 000 = _____ **b** 2 560 000 = _____ **c** 4815 = _____

d 0.008 = _____ **e** 0.000 029 = _____ **f** 0.3916 = _____

g 32.75 = _____ **h** 0.4 = _____ **i** 92 000 000 = _____

Question 2 Write as normal numbers.

a $7 \cdot 10^3$ = _____ **b** $3.8 \cdot 10^5$ = _____ **c** $1.095 \cdot 10^7$ = _____

d $9 \cdot 10^{-2}$ = _____ **e** $6.1 \cdot 10^{-4}$ = _____ **f** $4.17 \cdot 10^{-6}$ = _____

g $8.7 \cdot 10^{-1}$ = _____ **h** $4.957 \cdot 10^3$ = _____ **i** $6.26 \cdot 10^4$ = _____

Question 3 Express each answer in scientific notation.

a $2 \cdot 10^5 \cdot 9.8 \cdot 10^{-4}$ = _____ **b** $1.69 \cdot 10^3 \mid (1.3 \cdot 10^8)$ = _____

Question 4 Round off correct to one decimal place.

a 6.5478 _____ **b** 0.2875 _____ **c** 113.55 _____

Question 5 Round off correct to three decimal places.

a 12.6395 _____ **b** 0.03215 _____ **c** 2.6997 _____

Question 6 Write correct to two significant figures.

a 973 210 _____ **b** 0.003 185 _____ **c** 4080 _____

Question 7 Write correct to four significant figures.

a 31.296 8475 _____ **b** 204 378 _____ **c** 0.003 4712 _____

Question 8 Express in scientific notation correct to three significant figures.

a 219 478 _____ **b** 0.004 718 25 _____

Question 9 Find:

a $(2.64)^2 \mid 3.2 \cdot 1.8$ giving the answer correct to 2 decimal places.

_____

_____

b $6.3 \cdot 10^3 \mid (3 \cdot 10^7 \cdot 4 \cdot 10^{-2})$ giving the answer in scientific notation correct to 2 significant figures.

_____

_____

Basic arithmetic and algebra

Topic 5 - Powers and roots

QUESTION 1 Find the value of:

a $2^3 =$ _____ **b** $4^5 =$ _____ **c** $10^4 =$ _____ **d** $3^6 =$ _____

QUESTION 2 Use your calculator to find:

a $\sqrt{576} =$ _____ **b** $\sqrt[3]{216} =$ _____ **c** $\sqrt[5]{759375} =$ _____ **d** $\sqrt[8]{5764801} =$ _____

QUESTION 3 Find, correct to two decimal places, the value of:

a $2^{-1.5} =$ _____ **b** $3^{\frac{1}{2}} =$ _____ **c** $8^{0.6} =$ _____

d $\sqrt{3.6} =$ _____ **e** $\sqrt[4]{1.827} =$ _____ **f** $\sqrt[10]{6.543} =$ _____

QUESTION 4 Find, without a calculator:

a $\sqrt{\frac{4}{9}} =$ _____ **b** $\left(\frac{4}{5}\right)^2 =$ _____ **c** $\sqrt{0.64} =$ _____

d $\sqrt{1\frac{7}{9}} =$ _____ **e** $\left(2\frac{1}{2}\right)^2 =$ _____ **f** $\sqrt{5\frac{1}{16}} =$ _____

QUESTION 5 Write in scientific notation, correct to three significant figures:

a $13^8 =$ _____ **b** $2^{37} =$ _____ **c** $(0.6)^4 =$ _____

Basic arithmetic and algebra

Topic 6 - Combinations of operations

QUESTION 1 Find:

a $7 + 2 \cdot 3$

b $12 \cdot 2 + 7 \cdot 3$

c $16 \mid 8 \cdot 2$

d $(10 + 18) \mid 2 \cdot 4$

e $\{(15 - 3 \cdot 9) \mid 6\} \cdot 4 + 1$

f $9 \cdot \{(32 \mid 8 \cdot 3) - 7\}$

g $9 \cdot 7 \cdot 3 \cdot 0 \cdot 4 + 6$

h $8 \mid (2 \cdot 3 - 4) - (10 + 5)$

i $\{[12 \mid (3 \cdot 2) + 7] \cdot 5 \mid 3 - 8\} \cdot 4$

QUESTION 2 Find, correct to two decimal places.

a $\dfrac{9.6 + 4.8}{2.5 \cdot 3.7}$

b $\sqrt{5^2 + 9^2}$

c $\sqrt{\dfrac{2.8 + 3.6}{2.5 + 4.9}}$

d $\sqrt[3]{8.7 \cdot 4.1}$

e $\dfrac{\sqrt{9.6 \mid 1.81}}{4.6 \cdot 1.2}$

f $\dfrac{2.48}{\sqrt{3.72 - 2.84}}$

QUESTION 3 Give the answer in scientific notation, to four significant figures.

a $3.65 \cdot 10^8 \cdot 4.61 \cdot 10^5$

b $\dfrac{2.3 \cdot 10^7}{3.1 \cdot 10^8 \mid \left(2.4 \cdot 10^{-3}\right)}$

c $\dfrac{1.15 \cdot 10^6 + 7.9 \cdot 10^5}{9.35 \cdot 10^{-4}}$

QUESTION 4 Answer as a fraction.

a $\dfrac{1}{7 + 6 \cdot 2}$

b $\dfrac{\frac{2}{3} + \frac{3}{4}}{\frac{3}{5} - \frac{1}{2}}$

c $\dfrac{\left(\frac{1}{2}\right)^2 - \left(\frac{3}{5}\right)^3}{\left(\frac{2}{3}\right)^4}$

Basic arithmetic and algebra

Topic 7 - Basic algebraic operations

QUESTION 1 Simplify where possible.

a $2x + 7x - 3x =$ _____ **b** $8a^2 + 4a^2 =$ _____

c $9t - t =$ _____ **d** $5k - 6k + 8 =$ _____

e $6a + 4b + 3a - 5b =$ _____ **f** $7x^2 - x - 3x^2 - 2x + 5 =$ _____

g $-8m + 2n - mn =$ _____ **h** $3p - 9 + q - 7 + p =$ _____

i $9k + 3m - 7n^2 + 5n + m =$ _____ **j** $6x^3 + 3x - 5x^2 + 7x^2 - 4x^3 + x =$ _____

QUESTION 2 Simplify.

a $3x \cdot 5 =$ _____ **b** $2a \cdot 3a =$ _____

c $x \cdot 9x =$ _____ **d** $6p \cdot 4q =$ _____

e $y^2 \cdot y^4 =$ _____ **f** $7e^2 \cdot 2e^5 =$ _____

g $ab^4 \cdot a^2b^2 =$ _____ **h** $4x^2y^3 \cdot 5xy^6 =$ _____

i $2a^5bc^3 \cdot 5ab^2c^3 =$ _____ **j** $3p \cdot 4q \cdot 5r =$ _____

k $m^3n^2 \cdot 8m^2n \cdot mn^5 =$ _____

QUESTION 3 Simplify.

a $8k \mid 4 =$ _____ **b** $9g^9 \mid 3g^3 =$ _____ **c** $12x^3 \mid x =$ _____

d $12ab \mid 6b =$ _____ **e** $15a^{12}b^7 \mid 3a^2b^2 =$ _____ **f** $10x^4yz^5 \mid 5x^3yz^2 =$ _____

g $\dfrac{6ab}{15a} =$ _____ **h** $\dfrac{c^3d^2}{c^4d} =$ _____ **i** $\dfrac{8a^4b^9c^6}{12a^3b^8c^7} =$ _____

j $\dfrac{9e^4f^9}{12e^7fg} =$ _____ **k** $\dfrac{6x^2y^4}{2xy^2} =$ _____ **l** $\dfrac{3x^2y^3}{6x^2y^3} =$ _____

QUESTION 4 Find:

a $4(x^3)^2 =$ _____ **b** $4(x^3)^2 =$ _____ **c** $(x^2y^4)^3 =$ _____ **d** $7(pq)^6 =$ _____

e $(a^3bc^2)^2 =$ _____ **f** $(2p^4q^7)^5 =$ _____ **g** $5(xy^5z^2)^4 =$ _____ **h** $(3m^2n)^2 =$ _____

QUESTION 5 Simplify:

a $8x^2 + 5x \cdot 3x =$

_____

_____

b $(2ab^2)^3 \cdot 3(a^2b)^3 =$

_____

_____

c $12x^{12} \mid (2x^2 \cdot 3x^3) =$

_____

_____

d $\dfrac{8x^3y^4 \cdot 2xy^2}{(4x^2y)^2}$ _____

_____

e $\dfrac{3a^2b \cdot 4ab}{6a^2b^2 \mid 2b}$ _____

_____

Basic arithmetic and algebra

Topic 8 - Removing grouping symbols

QUESTION **1** Expand.

a $2(x + 7) =$ _____ **b** $3(a - 5) =$ _____ **c** $4(m - n) =$ _____

d $5(2k + 1) =$ _____ **e** $7(3x + 2y) =$ _____ **f** $9(xy - 3z) =$ _____

g $x(x + 4) =$ _____ **h** $a(a - 1) =$ _____ **i** $e(e + f) =$ _____

j $t(3t - 2u) =$ _____ **k** $p^2(p + 6q) =$ _____ **l** $n(n^2 - 5) =$ _____

m $4a(2a + 7) =$ _____ **n** $5k^2(3k - 2m) =$ _____ **o** $ab(a^2b - cd) =$ _____

p $6(a + b - c) =$ _____ **q** $4a(a - b - c) =$ _____

QUESTION **2** Expand.

a $-3(t + 4) =$ _____ **b** $-5(3a - 7) =$ _____ **c** $-2(6x - 5y) =$ _____

d $-e(e + 2) =$ _____ **e** $-a(b - c) =$ _____ **f** $-3x(2x + 7) =$ _____

g $-x^2(x + 5y) =$ _____ **h** $-4p^2(p^2 - q^2) =$ _____ **i** $-5ab(a^2b^2 + b) =$ _____

j $-7(5 - a - b + c) =$ _____ **k** $-a^2b(ab - a + b) =$ _____

QUESTION **3** Expand.

a $-(2 - a) =$ _____ **b** $-(x + 4) =$ _____ **c** $-(3p - 7q) =$ _____

d $-(t + 1) =$ _____ **e** $-(a - b) =$ _____ **f** $-(2x^2 - 1) =$ _____

g $-(2a + b - c) =$ _____ **h** $-(x^3 - 3x^2 + 5x - 2) =$ _____

QUESTION **4** Expand and simplify.

a $4(p - 8) + 3p - 17$

_____

_____

b $5(x^2 - 2x + 3) + x - 6$

_____

_____

c $3k - 7(2k - 1)$

_____

_____

d $x(x + 5) + 7(x + 5)$

_____

_____

e $2y(y + 4) - 5(y + 4)$

_____

_____

f $3x(x + y) - (2x - y)$

_____

_____

g $8a(2a - 3b) + 4b(4a - 5b)$

_____

_____

h $e(e - 1) - 6(e - 1)$

_____

_____

i $x^2(x^3 - 1) + 4x(3x^2 + 2)$

_____

_____

j $2a^2b^2(4a^2b + 3ab^2) - 5a^2b(a^2b^2 - ab^3)$

_____

_____

Basic arithmetic and algebra

Topic 9 - Binomial products

QUESTION **1** Expand.

a $(a + 7)(b + 6)$

b $(2y + 5)(3m - 4n)$

c $(6p - 11q)(9x - 2y)$

d $(x + 4)(x + 3)$

e $(a + 7)(a - 5)$

f $(e - 8)(e + 2)$

g $(p - 6)(p - 9)$

h $(x + y)(x + 2y)$

i $(3x - 2)(x + 5)$

j $(5m + 4)(2m - 4)$

k $(3a - 7b)(2a - b)$

l $(1 + 2a)(1 - 3a)$

m $(x^2 + 3)(x + 9)$

n $(n^3 - 6)(n^2 + 5)$

o $(3x^3 + 4)(2x - 7)$

QUESTION **2** Expand and simplify.

a $(n + 4)(n - 2) + 7n - 2$

b $(x - 9)(x - 1) - (x^2 - 9)$

c $a^2b^2 - (ab + c)(b - ac)$

d $(x + 5)(x + 4) + (x + 3)(x + 2)$

e $12 - (y + 4)(y + 3)$

f $(a - 3b)(a + 2) - (2a + 5)(b - 3)$

QUESTION **3** Subtract $7a - 3b$ from the product of $6a + 5$ and $2b - 7$

QUESTION **4** Expand and simplify.

a $(5a^2 + 3)(a^2 + 2a + 1)$

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

Basic arithmetic and algebra

Topic 10 - The square of a binomial and sum by difference

QUESTION **1** Find:

a $(x + 8)^2 =$ _____

b $(y - 5)^2 =$ _____

c $(t + 1)^2 =$ _____

d $(m - n)^2 =$ _____

e $(2p + 7)^2 =$ _____

f $(3x - 2y)^2 =$ _____

g $(4 - ab)^2 =$ _____

h $(1 - 7x)^2 =$ _____

i $(pq + r)^2 =$ _____

j $(2h^3 + 9)^2 =$ _____

k $(3a^2 - 1)^2 =$ _____

l $(5a^2 + b^2c)^2 =$ _____

m $(2ab + 3c)^2 =$ _____

n $(4x^2y - 2z^2)^2 =$ _____

QUESTION **2** Fill in the missing term so that each expression is a perfect square.

a $x^2 + 14x +$ _____

b $e^2 - 20e +$ _____

c $a^2 - 18ab +$ _____

d $k^2 + 2k +$ _____

e $4p^2 + 12p +$ _____

f $9y^2 - 42y +$ _____

g $25a^2 - 60ab +$ _____

h $b^2 +$ _____ $+ 36$

i _____ $+ 22t + 121$

j $16m^2 -$ _____ $+ 9n^2$

k $x^4 - 9x^2 +$ _____

l $a^2b^2 +$ _____ $+ 1$

QUESTION **3** Expand:

a $(a + 5)(a - 5) =$ _____

b $(k - 3)(k + 3) =$ _____

c $(2x + 11)(2x - 11) =$ _____

d $(3p + q)(3p - q) =$ _____

e $(5p + 1)(5p - 1) =$ _____

f $(2 - a)(2 + a) =$ _____

g $(6y - 7z)(6y + 7z) =$ _____

h $(a^2 - bc)(a^2 + bc) =$ _____

i $(1 + h)(1 - h) =$ _____

j $(x^2 + 4)(x^2 - 4) =$ _____

k $(ab - cd)(ab + cd) =$ _____

l $(e^3 + f^2)(e^3 - f^2) =$ _____

m $(5 - m^2)(5 + m^2) =$ _____

n $(a^2bc - de^2)(a^2bc + de^2) =$ _____

QUESTION **4** Expand and simplify.

a $(x + 7)(x - 7) + (x + 3)^2$

_____

_____

b $(2a + 1)(a - 1) + (3a - 1)^2$

_____

_____

c $(6m - 5n)^2 + (6m + 5n)^2$

_____

_____

d $(3a - 2b)(3a + 2b) - 3a(a - 2b)$

_____

_____

e $(2x - 5)^2 - (2x + 5)(2x - 5)$

_____

_____

f $(4x + 3y)(4x - 3y) - (5x - 3y)^2$

_____

_____

Basic arithmetic and algebra

Topic 11 - Substitution

QUESTION **1** Complete:

a $y = 3x - 5$ when $x = 4$

$y =$ _____

$=$ _____

b $b = 7 - 4a$ when $a = 3$

$b =$ _____

$=$ _____

c $p = q^2 + q$ when $q = 7$

$p =$ _____

$=$ _____

d $m = 3n^2$ when $n = 2$

$m =$ _____

$=$ _____

e $y = ax^2$ when $a = 7$ and $x = -2$

$y =$ _____

$=$ _____

f $v = u + at$ when $u = 5$, $a = 10$ and $t = 6$

$v =$ _____

$=$ _____

QUESTION **2** If $y = 2x^3 - 7x^2 + 5x - 3$ find y when:

a $x = 1$

_____

_____

b $x = -1$

_____

_____

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

_____

_____

QUESTION **3** Find the value of y when $x = -3$ if:

a $y = \sqrt{25 - x^2}$

_____

_____

b $y = \frac{x-1}{x+1}$

_____

_____

c $y = \sqrt[3]{\frac{24x^2}{125}}$

_____

_____

QUESTION **4** In the formula $N = \frac{A}{(1+r)^n}$ find (correct to one significant figure):

a N if $A = 80\,000$, $r = 0.05$ and $n = 6$

_____

_____

_____

_____

b r if $N = 5000$, $A = 9000$ and $n = 10$

_____

_____

_____

_____

Basic arithmetic and algebra

Topic 12 - Factorisation

QUESTION **1** Factorise:

a $7a + 28 =$ _____ **b** $3p - 21 =$ _____ **c** $4x + 20 =$ _____

d $5n - 5 =$ _____ **e** $6a + 6b =$ _____ **f** $x^2 - 5x =$ _____

g $ab + 9a =$ _____ **h** $2y^2 + 7y =$ _____ **i** $3k^2 - 9k =$ _____

j $7n^2 - 14n =$ _____ **k** $10p^2 + 15pq =$ _____ **l** $m^3 - m^2 =$ _____

m $a^3b^2 + a^2b^3 =$ _____ **n** $9e - 63e^2 =$ _____ **o** $abc + bc =$ _____

p $4p^4q^5 + 6p^5q^3 =$ _____ **q** $x^5y^3z^4 - x^3y^6z^5 =$ _____

r $5a + 15b + 10c =$ _____ **s** $8p + 12q - 16r - 20 =$ _____

t $x^2y + xy + x =$ _____ **u** $12a^4 - 3a^3 - 6a^2 + 9a =$ _____

QUESTION **2** Factorise these differences of two squares.

a $x^2 - 25 =$ _____ **b** $a^2 - 36 =$ _____

c $e^2 - 1 =$ _____ **d** $p^2 - 100 =$ _____

e $9 - n^2 =$ _____ **f** $k^2 - l^2 =$ _____

g $4m^2 - 49 =$ _____ **h** $9u^2 - 1 =$ _____

i $16p^2 - 81q^2 =$ _____ **j** $y^4 - 4 =$ _____

k $a^2b^2 - 9c^2 =$ _____ **l** $25x^2y^2 - 16z^6 =$ _____

QUESTION **3** Factorise fully.

a $2x^2 - 8$ **b** $ap^2 - aq^2$ **c** $7 - 7y^2$

_____ _____ _____

_____ _____ _____

QUESTION **4** Factorise by grouping.

a $x^2 + 8x + ax + 8a$

_____

_____

b $pq - 7p + qr - 7r$

_____

_____

c $a^2 + ab + a + b$

_____

_____

d $8am - 12an + 2bm - 3bn$

_____

_____

e $k^2 + ky - 3k - 3y$

_____

_____

f $ac - bc - ad + bd$

_____

_____

g $6k^2 + 3k + 4km + 2m$

_____

_____

h $xy - 4y - x + 4$

_____

_____

Basic arithmetic and algebra

Topic 13 - Factorising trinomials

QUESTION **1** Factorise these trinomials.

a $x^2 + 9x + 20 =$ _____

b $a^2 + 8a + 12 =$ _____

c $p^2 - 11p + 30 =$ _____

d $m^2 - 5m + 6 =$ _____

e $n^2 + 2n - 35 =$ _____

f $g^2 - 3g - 10 =$ _____

g $k^2 - 6k - 16 =$ _____

h $y^2 + 4y - 5 =$ _____

i $h^2 + 8hi + 15i^2 =$ _____

j $b^2 - 9bc + 18c^2 =$ _____

k $27 - 6t - t^2 =$ _____

l $e^2 - e - 12 =$ _____

m $d^2 - 14d + 48 =$ _____

n $q^2 - 9q - 22 =$ _____

o $z^2 + 8z + 16 =$ _____

p $u^2 + 8uv - 20v^2 =$ _____

QUESTION **2** Factorise by first taking out a common factor.

a $2x^2 + 18x + 28$

_____

_____

b $3n^2 + 9n - 12$

_____

_____

c $5p^2 - 50p + 105$

_____

_____

QUESTION **3** Factorise.

a $2x^2 + 7x + 6$

_____

_____

_____

b $3a^2 - 10a + 8$

_____

_____

_____

c $2p^2 - 5p - 25$

_____

_____

_____

d $5m^2 + 33m - 14$

_____

_____

_____

e $4a^2 + 19a + 12$

_____

_____

_____

f $6t^2 - 41t - 7$

_____

_____

_____

g $6a^2 + 13a + 6$

_____

_____

_____

h $12x^2 + 7x + 1$

_____

_____

_____

i $9m^2 - 34m + 21$

_____

_____

_____

j $4p^2 - 4p - 15$

_____

_____

_____

k $24x^2 + 14x - 3$

_____

_____

_____

l $24n^2 - 11n - 18$

_____

_____

_____

m $4a^2 + 28a + 49$

_____

_____

_____

n $5 - 7p + 2p^2$

_____

_____

_____

o $10x^2 + 11xy - 6y^2$

_____

_____

_____

Basic arithmetic and algebra

Topic 14 - Further factorisation

QUESTION 1 Write each trinomial as a perfect square.

a $x^2 + 10x + 25 =$ _____

b $a^2 - 24a + 144 =$ _____

c $e^2 - 12ef + 36f^2 =$ _____

d $4x^2 + 12x + 9 =$ _____

QUESTION 2 Factorise each sum or difference of two cubes.

a $x^3 + 8 =$ _____

b $27 - y^3 =$ _____

c $8a^3 + 1 =$ _____

d $27x^3 - 8y^3 =$ _____

e $125p^3 - 64q^3r^3 =$ _____

f $x^9 + 1000 =$ _____

QUESTION 3 Factorise.

a $x^2 - 9x$

b $x^2 - 9$

c $x^2 - 9x + 14$

d $a^3 - 27$

e $a^3 + 9a^2 + 3a + 27$

f $9a^2 + 18a + 5$

g $16e^2 - 49f^2$

h $e^2 - 14e + 49$

i $49e^2 + 49$

j $x^3 + 6x^2$

k $1 - 4a^2$

l $9 + 3p - 3q - pq$

QUESTION 4 Factorise fully.

a $x^3 - 9x$

b $x^3 - 2x^2 - 15x$

c $a^4 - 16$

d $5 - 5x^3$

e $x^2 - 25 + xy - 5y$

f $4x^2 - 20x + 16$

g $2ax + 6a - 8x - 24$

h $x^3 - 6x^2 - 4x + 24$

i $x^4 + x^3 - x - 1$

Basic arithmetic and algebra

Topic 15 - Basic operations with surds

QUESTION **1** Simplify where possible.

a $\sqrt{3}+\sqrt{3}=$ _____ **b** $2\sqrt{5}+3\sqrt{5}=$ _____ **c** $6\sqrt{7}-4\sqrt{7}=$ _____

d $5\sqrt{6}+\sqrt{6}=$ _____ **e** $\sqrt{11}+\sqrt{11}=$ _____ **f** $8\sqrt{10}-\sqrt{10}=$ _____

g $\sqrt{2}+9\sqrt{2}=$ _____ **h** $\sqrt{5}-\sqrt{5}=$ _____ **i** $\sqrt{2}+\sqrt{3}=$ _____

j $-4\sqrt{17}+7\sqrt{17}=$ _____ **k** $9\sqrt{10}-8\sqrt{10}=$ _____ **l** $3\sqrt{15}-5\sqrt{15}=$ _____

m $3\sqrt{7}+3\sqrt{5}=$ _____ **n** $\sqrt{3}-7\sqrt{3}=$ _____ **o** $6\sqrt{2}-2\sqrt{6}=$ _____

p $8\sqrt{2}-3\sqrt{2}+4\sqrt{2}+\sqrt{2}=$ _____ **q** $9\sqrt{7}-\sqrt{7}-3\sqrt{7}+2\sqrt{7}=$ _____

QUESTION **2** Simplify by collecting like surds.

a $7\sqrt{3}+5\sqrt{2}+2\sqrt{3}=$ _____ **b** $\sqrt{7}+4\sqrt{5}-3\sqrt{7}+\sqrt{5}=$ _____

c $8\sqrt{7}-3\sqrt{7}+7-2\sqrt{7}=$ _____ **d** $3\sqrt{6}+5+9\sqrt{3}-2\sqrt{3}-\sqrt{6}=$ _____

e $6+\sqrt{2}+\sqrt{6}+3\sqrt{2}+3=$ _____ **f** $-2\sqrt{5}+7\sqrt{2}-3\sqrt{5}+4\sqrt{2}=$ _____

g $3\sqrt{10}-\sqrt{5}-5\sqrt{10}+8=$ _____ **h** $\sqrt{3}-\sqrt{6}+2\sqrt{3}-7\sqrt{6}+\sqrt{2}=$ _____

QUESTION **3** Find these products.

a $\sqrt{2}\cdot\sqrt{3}=$ _____ **b** $\sqrt{7}\cdot\sqrt{5}=$ _____ **c** $\sqrt{11}\cdot\sqrt{2}=$ _____

d $\sqrt{10}\cdot\sqrt{7}=$ _____ **e** $\sqrt{13}\cdot\sqrt{6}=$ _____ **f** $\sqrt{5}\cdot\sqrt{11}=$ _____

g $2\sqrt{3}\cdot\sqrt{2}=$ _____ **h** $4\sqrt{5}\cdot\sqrt{3}=$ _____ **i** $-\sqrt{7}\cdot 2\sqrt{2}=$ _____

j $3\sqrt{5}\cdot 4\sqrt{2}=$ _____ **k** $-9\sqrt{11}\cdot 7\sqrt{7}=$ _____ **l** $-6\sqrt{6}\cdot -5\sqrt{5}=$ _____

m $\sqrt{3}\cdot\sqrt{2}\cdot\sqrt{5}=$ _____ **n** $2\sqrt{5}\cdot 3\sqrt{3}\cdot 10\sqrt{7}=$ _____

QUESTION **4** Find:

a $\sqrt{6}\ |\sqrt{2}=$ _____ **b** $\sqrt{10}\ |\sqrt{5}=$ _____ **c** $\sqrt{87}\ |\sqrt{3}=$ _____

d $6\sqrt{6}\ |3\sqrt{3}=$ _____ **e** $-12\sqrt{14}\ |-3\sqrt{7}=$ _____ **f** $-9\sqrt{30}\ |3\sqrt{5}=$ _____

g $10\sqrt{22}\ |-\sqrt{2}=$ _____ **h** $18\sqrt{5}\ |9\sqrt{5}=$ _____ **i** $8\sqrt{35}\ |8\sqrt{7}=$ _____

j $\sqrt{28}\ |\sqrt{7}=$ _____ **k** $9\sqrt{27}\ |\sqrt{3}=$ _____ **l** $16\sqrt{75}\ |8\sqrt{3}=$ _____

m $\dfrac{\sqrt{15}}{\sqrt{3}}=$ _____ **n** $\dfrac{8\sqrt{10}}{4\sqrt{2}}=$ _____ **o** $\dfrac{\sqrt{7}}{\sqrt{21}}=$ _____ **p** $\dfrac{3\sqrt{30}}{6\sqrt{10}}=$ _____

Basic arithmetic and algebra

Topic 16 - Simplifying surds

QUESTION **1** Simplify:

a $\sqrt{8}$ = _____

b $\sqrt{45}$ = _____

c $\sqrt{28}$ = _____

d $\sqrt{700}$ = _____

e $\sqrt{98}$ = _____

f $\sqrt{32}$ = _____

g $3\sqrt{18}$ = _____

h $5\sqrt{27}$ = _____

i $-2\sqrt{300}$ = _____

QUESTION **2** Simplify:

a $\sqrt{8} + \sqrt{18}$

b $\sqrt{75} - \sqrt{12}$

c $\sqrt{500} + \sqrt{20}$

d $7\sqrt{24} + \sqrt{54}$

e $2\sqrt{147} - 3\sqrt{243}$

f $-6\sqrt{32} + 5\sqrt{50}$

g $4\sqrt{125} - 2\sqrt{45} - 3\sqrt{175}$

h $7\sqrt{2} - 3\sqrt{96} + 8\sqrt{8} - \sqrt{600}$

QUESTION **3** Find:

a $\left(\sqrt{3}\right)^2$ = _____

b $\left(\sqrt{10}\right)^2$ = _____

c $\left(\sqrt{5}\right)^2$ = _____

d $\left(\sqrt{37}\right)^2$ = _____

e $\left(3\sqrt{2}\right)^2$ = _____

f $\left(2\sqrt{7}\right)^2$ = _____

g $\left(4\sqrt{3}\right)^2$ = _____

h $\left(10\sqrt{10}\right)^2$ = _____

QUESTION **4** Express as entire surds.

a $2\sqrt{3}$

b $7\sqrt{2}$

c $9\sqrt{5}$

d $6\sqrt{6}$

e $2\sqrt{15}$

f $8\sqrt{10}$

g $4\sqrt{11}$

h $10\sqrt{7}$

Basic arithmetic and algebra

Topic 17 - Further products with surds

QUESTION 1 Find these products and simplify.

a $\sqrt{12} \cdot \sqrt{3} =$ _____

b $\sqrt{2} \cdot \sqrt{8} =$ _____

c $3\sqrt{6} \cdot \sqrt{24} =$ _____

d $\sqrt{6} \cdot \sqrt{2} =$ _____

e $\sqrt{3} \cdot \sqrt{21} =$ _____

f $\sqrt{10} \cdot \sqrt{15} =$ _____

g $2\sqrt{3} \cdot 3\sqrt{6} =$ _____

h $4\sqrt{5} \cdot -2\sqrt{10} =$ _____

i $7\sqrt{14} \cdot \sqrt{21} =$ _____

QUESTION 2 Expand:

a $2\left(\sqrt{3} + \sqrt{5}\right)$

b $5\left(2\sqrt{7} - \sqrt{6}\right)$

c $-8\left(3\sqrt{10} - 2\sqrt{2}\right)$

d $\sqrt{3}\left(\sqrt{7} - \sqrt{2}\right)$

e $3\sqrt{2}\left(8\sqrt{3} + 7\right)$

f $4\sqrt{5}\left(\sqrt{7} - 3\sqrt{6}\right)$

g $\sqrt{5}\left(\sqrt{5} + 3\right)$

h $2\sqrt{2}\left(\sqrt{7} - \sqrt{2}\right)$

i $3\sqrt{6}\left(9 - 2\sqrt{6}\right)$

j $\sqrt{2}\left(\sqrt{6} - \sqrt{2}\right)$

k $3\sqrt{3}\left(\sqrt{15} + 2\sqrt{5}\right)$

l $\sqrt{6}\left(\sqrt{3} - 2\sqrt{2}\right)$

QUESTION 3 Expand these binomial products.

a $\left(\sqrt{7} - \sqrt{3}\right)\left(2 - \sqrt{2}\right)$

b $\left(9 + 2\sqrt{5}\right)\left(2\sqrt{3} - 5\sqrt{2}\right)$

QUESTION 4 Expand and simplify.

a $\left(7 + 5\sqrt{10}\right)\left(3\sqrt{10} - 4\right)$

b $\left(3\sqrt{2} - 2\sqrt{7}\right)\left(5\sqrt{2} + \sqrt{7}\right)$

c $\left(\sqrt{3} + \sqrt{5}\right)\left(\sqrt{6} + \sqrt{5}\right)$

d $\left(9 - 3\sqrt{2}\right)\left(\sqrt{6} - 7\sqrt{2}\right)$

Basic arithmetic and algebra

Topic 18 - Special products with surds

QUESTION **1** Expand and simplify.

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

b $\left(7-\sqrt{5}\right)^2$

c $\left(5+\sqrt{3}\right)^2$

d $\left(\sqrt{2}-\sqrt{7}\right)^2$

e $\left(3\sqrt{5}-2\sqrt{6}\right)^2$

f $\left(4\sqrt{3}-11\right)^2$

g $\left(6\sqrt{2}+\sqrt{5}\right)^2$

h $\left(5\sqrt{10}-1\right)^2$

QUESTION **2** Find:

a $\left(\sqrt{7}+\sqrt{3}\right)\left(\sqrt{7}-\sqrt{3}\right)$

b $\left(8-\sqrt{2}\right)\left(8+\sqrt{2}\right)$

c $\left(\sqrt{3}+4\right)\left(\sqrt{3}-4\right)$

d $\left(\sqrt{5}-\sqrt{2}\right)\left(\sqrt{5}+\sqrt{2}\right)$

e $\left(\sqrt{6}+1\right)\left(\sqrt{6}-1\right)$

f $\left(2\sqrt{7}+3\right)\left(2\sqrt{7}-3\right)$

g $\left(3\sqrt{10}-\sqrt{6}\right)\left(3\sqrt{10}+\sqrt{6}\right)$

h $\left(2\sqrt{3}+3\sqrt{2}\right)\left(2\sqrt{3}-3\sqrt{2}\right)$

i $\left(7\sqrt{5}+3\sqrt{3}\right)\left(7\sqrt{5}-3\sqrt{3}\right)$

j $\left(4\sqrt{6}-9\right)\left(4\sqrt{6}+9\right)$

k $\left(2\sqrt{2}+4\sqrt{3}\right)\left(2\sqrt{2}-4\sqrt{3}\right)$

l $\left(\sqrt{11}-5\sqrt{2}\right)\left(\sqrt{11}+5\sqrt{2}\right)$

Basic arithmetic and algebra

Topic 19 - Rationalising the denominator (1)

QUESTION 1 Rationalise the denominator.

a $\frac{1}{\sqrt{3}} =$ _____

b $\frac{2}{\sqrt{5}} =$ _____

c $\frac{\sqrt{6}}{\sqrt{7}} =$ _____

d $\frac{6}{\sqrt{6}} =$ _____

e $\frac{8}{\sqrt{2}} =$ _____

f $\frac{5}{\sqrt{10}} =$ _____

g $\frac{\sqrt{5}}{\sqrt{11}} =$ _____

h $\frac{9}{\sqrt{15}} =$ _____

i $\frac{\sqrt{3}}{\sqrt{6}} =$ _____

QUESTION 2 For each binomial surd write the conjugate.

a $\sqrt{7} + \sqrt{2}$ _____

b $3 - \sqrt{5}$ _____

c $4\sqrt{3} - 3\sqrt{6}$ _____

d $\sqrt{10} - 7$ _____

e $2\sqrt{6} + 5$ _____

f $8\sqrt{2} - 7$ _____

g $1 - 4\sqrt{7}$ _____

h $3\sqrt{11} + 5\sqrt{5}$ _____

QUESTION 3 Show that the product of each binomial surd with its conjugate is rational.

a $2 + \sqrt{3}$

b $3\sqrt{5} - 4\sqrt{2}$

Basic arithmetic and algebra

Topic 19 - Rationalising the denominator (2)

QUESTION **1** Rationalise the denominator.

a $\dfrac{1}{5-\sqrt{2}}$

b $\dfrac{5}{\sqrt{6}+\sqrt{2}}$

c $\dfrac{\sqrt{3}+\sqrt{2}}{\sqrt{5}+\sqrt{3}}$

d $\dfrac{\sqrt{2}-1}{\sqrt{2}+1}$

e $\dfrac{6}{2\sqrt{2}+\sqrt{5}}$

f $\dfrac{4\sqrt{2}+\sqrt{5}}{2\sqrt{5}-\sqrt{6}}$

QUESTION **2** Find the value of the integers x, y and z if:

a $\dfrac{6}{2\sqrt{7}-5} = x + y\sqrt{z}$

b $\dfrac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}} = x + y\sqrt{z}$

Basic arithmetic and algebra

Topic 20 - Simplifying algebraic fractions

QUESTION 1 Simplify:

a $\frac{8x}{12} =$ _____ **b** $\frac{6a}{9a} =$ _____ **c** $\frac{5e}{7e} =$ _____

d $\frac{4k}{12k} =$ _____ **e** $\frac{9p}{18} =$ _____ **f** $\frac{6h}{2} =$ _____

g $\frac{10e}{e} =$ _____ **h** $\frac{6a}{3a^2} =$ _____ **i** $\frac{9m^2}{9} =$ _____

j $\frac{12n^2}{3n} =$ _____ **k** $\frac{9ab}{12b} =$ _____ **l** $\frac{5x^2}{15x^3} =$ _____

m $\frac{abc}{a^2bc^3} =$ _____ **n** $\frac{8pq}{2p^2} =$ _____ **o** $\frac{3xy}{9x^2y} =$ _____

p $\frac{10m^2}{5mn} =$ _____ **q** $\frac{7x^2y}{5xy^2} =$ _____ **r** $\frac{2a^2b^2c}{4a^2b^2c} =$ _____

s $\frac{4e^3f^7}{8e^8f^8} =$ _____ **t** $\frac{16mn^2}{20m^2n} =$ _____

QUESTION 2 Factorise and simplify:

a $\frac{2x+8}{4}$ _____ _____

b $\frac{6x+9y}{8x+12y}$ _____ _____

c $\frac{12}{16a-4b}$ _____ _____

d $\frac{x^2-1}{x^2+x}$ _____ _____

e $\frac{x^2+3x-18}{x^2+9x+18}$ _____ _____

f $\frac{2x^2}{2x^2-10x}$ _____ _____

g $\frac{9e-6}{3}$ _____ _____

h $\frac{x^2-12x+32}{x-8}$ _____ _____

i $\frac{5n+1}{20n+4}$ _____ _____

j $\frac{x}{x^2-7x}$ _____ _____

k $\frac{m+4}{m^2+5m+4}$ _____ _____

l $\frac{2m+6n}{4m+12n}$ _____ _____

Basic arithmetic and algebra

Topic 21 - Addition and subtraction of algebraic fractions

QUESTION **1** Simplify:

a $\frac{x+5}{3}+\frac{2x-4}{3}$

b $\frac{7}{x}-\frac{4}{x}$

c $\frac{3a}{b}+\frac{2a}{c}$

d $\frac{9n}{m}-\frac{4m}{n}$

e $\frac{e-2}{e+2}-\frac{e-3}{e+2}$

f $\frac{6x}{5}-\frac{2y}{7}$

g $\frac{2x}{3}+\frac{5x}{9}$

h $\frac{3a}{4}-\frac{2a}{7}$

i $1-\frac{a}{b}$

j $\frac{a+3}{2}+\frac{a+2}{3}$

k $\frac{x-4}{x}-\frac{a+3}{a}$

l $\frac{e+5}{6}-\frac{e-2}{4}$

QUESTION **2** Express as a single fraction, leaving the denominator in factorised form.

a $\frac{1}{x^2+3x-10}+\frac{1}{x^2+x-6}$

b $\frac{1}{a^2-5a+4}-\frac{1}{a^2-4a}$

c $\frac{x+5}{x^2+x}+\frac{x+4}{x^2-x}$

Basic arithmetic and algebra

Topic 22 - Multiplication and division of algebraic fractions

QUESTION **1** Find these products.

a $\frac{a}{b} \cdot \frac{c}{d}$

b $\frac{x}{2} \cdot \frac{4}{x}$

c $\frac{3t^2}{8u} \cdot \frac{4v}{9t}$

d $\frac{x+2}{x+5} \cdot \frac{x+5}{x+2}$

QUESTION **2** Divide:

a $\frac{e}{6} \mid \frac{e}{2}$

b $\frac{n^2}{5m} \mid \frac{m}{n}$

c $\frac{a-2}{a-1} \mid \frac{a+2}{a-1}$

d $\frac{x+5}{2} \mid \frac{x+5}{6}$

QUESTION **3** Simplify:

a $\frac{x^2-3x}{x+4} \cdot \frac{x^2+4x}{x^2+3x-18}$

b $\frac{x^2+9x+14}{x^2+3x+2} \cdot \frac{x^2+10x+9}{x^2+16x+63}$

c $\frac{a^2-9}{a^2-9a} \cdot \frac{a^2-7a-18}{a^2+5a+6}$

QUESTION **4** Simplify:

a $\frac{1}{a^2+5a+6} \mid \frac{1}{a^2+7a+12}$

b $\frac{a+2}{a^2+3a} \mid \frac{a^2+2a}{a+3}$

c $\frac{x^2+6x+5}{x^2+6x+8} \mid \frac{x^2+4x+3}{x^2+9x+20}$

Basic arithmetic and algebra

Topic 23 - Linear equations

QUESTION **1** Solve:

a $7a - 17 = 46$

b $8k + 5 = -7$

c $12 - 5e = 17$

d $4m - 11 = 3m + 19$

e $9x + 32 = 45 - 4x$

f $3(4y - 1) = 81$

g $\frac{a+9}{7} = 12$

h $\frac{x}{5} - 9 = 1$

i $\frac{3e}{e-4} = \frac{2}{3}$

j $6(2x + 5) - 2(5x - 4) = 10$

k $8n - 20 + 3n = 16 - 2n + n$

l $\frac{2t-7}{5} = \frac{4-3t}{3}$

m $5(3k + 2) - 4(2k - 3) = 6(k + 7)$

n $\frac{4x+3}{3x-7} = \frac{5}{13}$

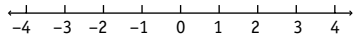
o $\frac{5e}{7} - \frac{e-1}{4} = 3e - 53$

Basic arithmetic and algebra

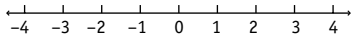
Topic 24 - Linear inequalities

QUESTION 1 Graph on the given number line.

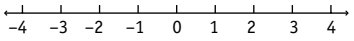
a $x \geq -1$



b $x < 2$



c $-2 \leq x < 0$



QUESTION 2 Solve:

a $2x - 1 \leq 7$

b $3x > 15 - 2x$

c $\frac{x}{6} + 8 < -2$

d $\frac{2x - 5}{3} \leq 9$

e $9x - 2 > 3x + 8$

f $7x + 3 \geq 17 - 3x$

QUESTION 3 Solve:

a $-5x \leq 20$

b $-x \geq -4$

c $-\frac{x}{2} > 6$

d $11 - 3x < -1$

e $\frac{4 - x}{3} \leq 2$

f $-8x + 5 \geq 9$

QUESTION 4 Solve:

a $15 > 7 - 4x$

b $6 - \frac{x}{4} \leq 2$

c $\frac{x}{3} + \frac{2x}{5} \geq 1$

d $4x - 3 \geq 11x + 18$

e $\frac{9 - 2x}{5} < -\frac{1}{2}$

f $\frac{x - 6}{7} > 3 - \frac{x}{2}$

Basic arithmetic and algebra

Topic 25 - Absolute values

QUESTION 1 Evaluate:

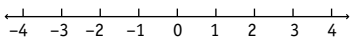
a $|-5| =$ _____ **b** $|-2| + |3| =$ _____ **c** $|5 - 7| =$ _____

d $|5| - |7| =$ _____ **e** $|-5| \cdot |-4| =$ _____ **f** $2|-3| =$ _____

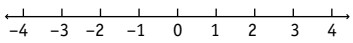
g $|-6 + 2| =$ _____ **h** $|-6| + |2| =$ _____ **i** $3|-4| - 5|-2| =$ _____

QUESTION 2 Graph on the given number line.

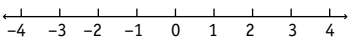
a $|x| = 2$



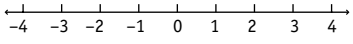
b $|x| < 2$



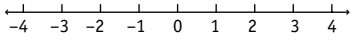
c $|x| \geq 1$



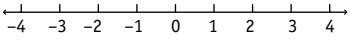
d $|x| > 3$



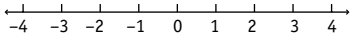
e $|x| \leq 4$



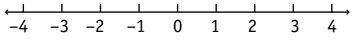
f $|x - 1| = 2$



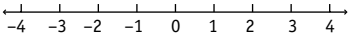
g $|x + 1| > 1$



h $|x - 2| < 2$

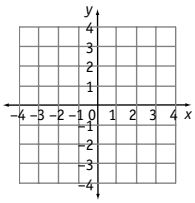


i $|x + 3| \geq 1$

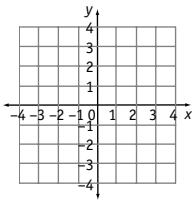


QUESTION 3 Graph on the given number plane.

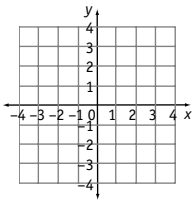
a $|x| = 2$



b $|y| = 3$

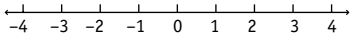


c $y = |x|$



QUESTION 4 Solve:

a $|2x + 3| = 1$



_____

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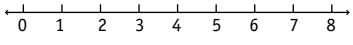
b $|5 - 3x| = 2$



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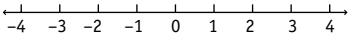
c $|4x - 1| = 0$



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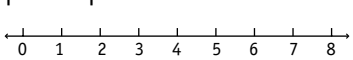
d $|2x - 5| \leq 3$



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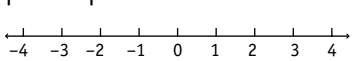
e $|3x + 2| > 1$



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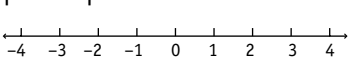
f $|1 - 2x| \geq 5$



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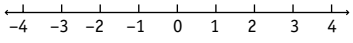
g $|6x + 3| < 1$



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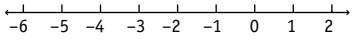
h $|2x + 2| \geq 3$



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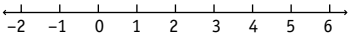
i $|3x - 4| \leq 2$



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Basic arithmetic and algebra

Topic 26 - Quadratic equations

QUESTION **1** Solve:

a $x(x - 6) = 0$

b $(x + 3)(x - 5) = 0$

c $(2a - 5)(a + 7) = 0$

QUESTION **2** Solve:

a $x^2 + 8x = 0$

b $x^2 - 9x + 20 = 0$

c $x^2 + 11x + 28 = 0$

d $e^2 + 7e - 30 = 0$

e $15 - 2m - m^2 = 0$

f $p^2 + 16p + 64 = 0$

QUESTION **3** Solve by factorising.

a $2x^2 - 13x + 15 = 0$

b $14x^2 + x - 4 = 0$

c $15x^2 + 19x + 6 = 0$

QUESTION **4** Solve:

a $x^2 = 10x - 24$

b $x^2 + 5x = 14$

c $(x - 8)(x + 3) = 42$

QUESTION **5** Solve by taking square roots.

a $(x + 7)^2 = 81$

b $(3x - 2)^2 = 4$

c $(x + 5)^2 = 7$

Basic arithmetic and algebra

Topic 27 - The quadratic formula

QUESTION **1** Solve, leaving the answer in simplest surd form.

a $2x^2 - 3x - 33 = 0$

b $x^2 - 7x + 5 = 0$

c $2x^2 + 9x + 5 = 0$

d $x^2 + 8x + 3 = 0$

e $x^2 + 10x + 7 = 0$

f $5x^2 - 6x - 1 = 0$

QUESTION **2** Solve, giving each answer correct to three decimal places.

a $3x^2 + 5x - 7 = 0$

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

c $3x^2 - 4x - 2 = 0$

Basic arithmetic and algebra

Topic 28 - Simultaneous equations – solving by substitution

QUESTION **1** Solve using the substitution method.

a $y = 8x + 15$ (i)
$y = 5x + 3$ (ii)

b $y = 11x - 7$ (i)
$y = 2x + 11$ (ii)

c $x + y = 5$ (i)
$y = 9 - 2x$ (ii)

d $4x + 3y = 33$ (i)
$y = 5x - 8$ (ii)

e $7a - 5b + 6 = 0$ (i)
$a = 4b + 1$ (ii)

f $8x - 9y = 26$ (i)
$3x + y = 1$ (ii)

g $2a - b - 18 = 0$ (i)
$5a - 3b - 48 = 0$ (ii)

h $6x + 11y = 87$ (i)
$3x + 2y = 12$ (ii)

i $9p - 7q = 31$ (i)
$4p + 3q = 81$ (ii)

Basic arithmetic and algebra

Topic 29 - Simultaneous equations – solving by elimination (1)

QUESTION **1** Solve by first adding the two equations.

a $4x + y = 27$ (i)
$5x - y = 18$ (ii)

b $9x - 2y = 13$ (i)
$7x + 2y = 3$ (ii)

c $7a + 6b - 107 = 0$ (i)
$5a - 6b - 25 = 0$ (ii)

QUESTION **2** Solve by first subtracting one equation from the other.

a $6x + 5y = 17$ (i)
$4x + 5y = 23$ (ii)

b $7e - 3f + 6 = 0$ (i)
$2e - 3f + 21 = 0$ (ii)

c $8x + 3y - 68 = 0$ (i)
$8x - 9y - 20 = 0$ (ii)

QUESTION **3** Solve:

a $12p - 7q + 1 = 0$ (i)
$8p + 7q - 11 = 0$ (ii)

b $9a + b = 78$ (i)
$11a + b = 94$ (ii)

c $7x - 5y = 104$ (i)
$7x + 5y = 64$ (ii)

Basic arithmetic and algebra

Topic 29 - Simultaneous equations – solving by elimination (2)

QUESTION **1** Solve:

a $10a + 3b = 56$ (i)
$4a + b = 22$ (ii)

b $6x + 4y - 58 = 0$ (i)
$x - 8y + 25 = 0$ (ii)

c $9x - 5y = 6$ (i)
$3x - 4y = 9$ (ii)

d $9x - 2y - 30 = 0$ (i)
$7x + 5y + 16 = 0$ (ii)

e $11a - 4b + 83 = 0$ (i)
$5a + 6b + 26 = 0$ (ii)

f $6x + 11y + 24 = 0$ (i)
$5x + 4y + 20 = 0$ (ii)

Basic arithmetic and algebra

Topic Test — PART A

Instructions This part consists of 15 multiple-choice questions
Each question is worth 1 mark
Calculators may be used
Fill in only ONE CIRCLE for each question

Time allowed: 15 minutes **Total marks = 15**

Marks

1 The value of $\frac{0.23 + 0.8}{0.4 \mid 0.2}$ is

Ⓐ 0.515 Ⓑ 0.63 Ⓒ 10.23 Ⓓ 12.875 **1**

2 Which is correct? $\sqrt{5}$ is ... I real II rational

Ⓐ both I and II Ⓑ I but not II Ⓒ II but not I Ⓓ neither I nor II **1**

3 The reciprocal of $2\frac{3}{4}$ is

Ⓐ $3\frac{1}{3}$ Ⓑ $1\frac{5}{6}$ Ⓒ $\frac{2}{3}$ Ⓓ $\frac{4}{11}$ **1**

4 $\frac{5}{8}$ as a decimal equals

Ⓐ 0.58 Ⓑ 0.85 Ⓒ 0.625 Ⓓ none of these **1**

5 The price of dining furniture has been discounted by 15%. If it sold for $2278, the original price was

Ⓐ $1936 Ⓑ $2428 Ⓒ $2620 Ⓓ $2680 **1**

6 Written in scientific notation 0.000 08 equals

Ⓐ $8 \cdot 10^{5}$ Ⓑ $8 \cdot 10^{4}$ Ⓒ $8 \cdot 10^{-4}$ Ⓓ $8 \cdot 10^{-5}$ **1**

7 Rounded off to four significant figures 0.203 561 equals

Ⓐ 0.2356 Ⓑ 0.2036 Ⓒ 0.20356 Ⓓ 0.204 **1**

8 $3^{4} \cdot 3^{5}$ equals

Ⓐ 3^{9} Ⓑ 3^{20} Ⓒ 9^{9} Ⓓ 9^{20} **1**

9 The value of 8.2^{-1} correct to two decimal places is

Ⓐ 0.01 Ⓑ 0.12 Ⓒ 0.82 Ⓓ 1.22 **1**

Topic Test — PART A

Marks

10 The exact value of $\sqrt{1\frac{4}{9}}$ is

Ⓐ 1.2 Ⓑ $1\frac{2}{3}$ Ⓒ $\frac{\sqrt{13}}{3}$ Ⓓ none of these [1]

11 Expressed as a recurring decimal, $\frac{9}{22}$ equals

Ⓐ $0.40\dot{9}$ Ⓑ $0.4\dot{0}\dot{9}$ Ⓒ $0.\dot{4}0\dot{9}$ Ⓓ $0.\dot{4}\dot{0}9\dot{0}$ [1]

12 In scientific notation, correct to three significant figures, the value of $5.62895 \cdot 10^{15}$ divided by the product of $4.76 \cdot 10^{3}$ and $3.9582 \cdot 10^{7}$ is

Ⓐ $2.99 \cdot 10^{4}$ Ⓑ $4.68 \cdot 10^{19}$ Ⓒ $1.42 \cdot 10^{8}$ Ⓓ $3.35 \cdot 10^{-5}$ [1]

13 When $n = -3$, $4n^2$ equals

Ⓐ −144 Ⓑ −36 Ⓒ 36 Ⓓ 144 [1]

14 When factorised, $2m^2 + 7m - 15$ equals

Ⓐ $(2m - 3)(m + 5)$ Ⓑ $(2m - 3)(m - 5)$ Ⓒ $(2m + 3)(m - 5)$ Ⓓ $(2m + 3)(m + 5)$ [1]

15 If $\frac{-x}{3} \geq 6$, then

Ⓐ $x \leq -2$ Ⓑ $x \geq -2$ Ⓒ $x \leq -18$ Ⓓ $x \geq -18$ [1]

Total marks achieved for PART A ____/15

Basic arithmetic and algebra

Topic Test — PART B

Instructions This section consists of 25 questions
Show all necessary working

Time allowed: 1 hour **Total marks = 85**

Marks

16 Express as fractions in simplest form.

a $0.\dot{7}\dot{2}$

b $0.325\dot{}$

2

17 Write in scientific notation.

a 840 000 000 **b** 2000 **c** 0.000 096

3

18 Write as normal numbers.

a $3.2 \cdot 10^{5}$ **b** $4.8 \cdot 10^{-2}$ **c** $6.15 \cdot 10^{-4}$

3

19 Round off correct to two decimal places.

a 7.3518 **b** 13.565 **c** 0.299

3

20 Round off correct to three significant figures.

a 0.030 785 **b** 2 576 482 **c** 10.03857

3

21 Simplify:

a $3x^2 + 6x + 4x$ **b** $9y - 5y - y$ **c** $12k + 3k^2 + 8 - 7k + 1$

Marks

21 **d** $7e^2 \cdot 8e + 12e^3$ **e** $-3p^2 + 2p \cdot 4p$ **f** $6k \cdot 8k \mid 12k^2$

6

22 Expand and simplify.

a $3x + 2(8 - x)$ **b** $6x^2 + 5x - 4(3 - 7x)$ **c** $12(2p - 3) - (4p - 9)$

3

23 If $x = 2$, $y = -3$ and $z = 5$, find the value of:

a $y^2 - x + z$ **b** $4x^2$ **c** $\frac{z - y}{4x}$

3

24 Expand:

a $(x + 7)(x - 4)$ **b** $(3m + 2)(m + 1)$

c $(2e - 7)^2$ **d** $(a + 4y)(a - 4y)$

4

25 Expand and simplify.

a $(2a + 3)(a^2 + 5a - 4)$ **b** $(3x + 2y)(3x - 2y) - (2x + 3y)^2$

2

26 Factorise:

a $12e^2 - 8e$ **b** $x^2 - 25$ **c** $x^2 + 16x + 63$

d $x^3 + 8$ **e** $3x^2 - 16x + 5$ **f** $x^2 - 2xy + x - 2y$

6

27 Factorise fully.

a $5x^3 - 40$ **b** $2x^2 + 12x + 18$ **c** $x^4 - 16$

3

Marks

28 Simplify:

a $4\sqrt{2} + 3\sqrt{2} + 2\sqrt{2}$

b $3\sqrt{7} - \sqrt{7}$

c $8\sqrt{3} - \sqrt{5} + 6\sqrt{3} + 2\sqrt{5}$

d $\sqrt{2} \cdot \sqrt{5}$

e $\left(\sqrt{7}\right)^2$

f $6\sqrt{2} \cdot 3\sqrt{3}$

g $9\sqrt{10} \mid 3\sqrt{2}$

h $\sqrt{20}$

i $\sqrt{8} + \sqrt{18}$

9

29 Expand and simplify.

a $\left(\sqrt{2} + \sqrt{3}\right)\left(2\sqrt{3} - \sqrt{5}\right)$

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

c $\left(\sqrt{5} + 2\right)\left(\sqrt{5} - 2\right)$

3

30 Rationalise the denominator.

a $\frac{1}{\sqrt{5}}$

b $\frac{\sqrt{2} + \sqrt{3}}{\sqrt{2} - \sqrt{3}}$

2

31 Simplify:

a $\frac{4a + 20}{4}$

b $\frac{x^2 - 1}{x^2 - x}$

c $\frac{2}{6m + 4n}$

3

Marks

31 **d** $\frac{2x}{7} + \frac{3x}{5}$

e $\frac{7e-1}{4} - \frac{e+2}{3}$

f $\frac{x^2+3x}{x-2} \cdot \frac{x^2-6x+8}{x^2-4x}$

g $\frac{1}{n^2+8n+12} \mid \frac{1}{n^2+n-2}$

7

32 Solve:

a $7x - 15 = 3x + 11$

b $6(2a - 9) - 5(a - 4) = 3a$

c $\frac{4x}{x+3} = \frac{2}{3}$

d $\frac{5m}{2} - \frac{m+3}{5} = 4 - m$

4

33 Solve:

a $3x + 2 \leq 7$

b $8 - 5x > -2$

c $\frac{4x-1}{2} \geq 3x + 5$

3

Topic Test — PART B

Marks

34 Simplify:

a $|-4| + |2|$ _____

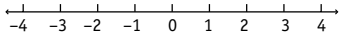
b $|-4 + 2|$ _____

c $|2| - |-4|$ _____

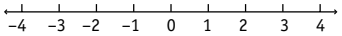
3

35 Graph on the given number line.

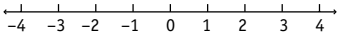
a $x < -2$



b $|x| \leq 3$



c $|x| > 1$



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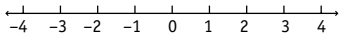
36 Solve:

a $|2x - 1| = 3$



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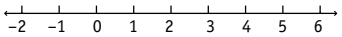
b $|x - 2| \leq 4$



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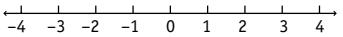
c $|3x + 1| > 2$



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37 Solve:

a $x^2 + 8x - 20 = 0$

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b $10x^2 - 13x + 3 = 0$

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2

38 Solve using the quadratic formula.

a $3x^2 + 7x + 1 = 0$ [to 3 d.p.]

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b $2x^2 - 4x - 7 = 0$ [simplest surd form]

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2

Marks

39 Solve the pair of simultaneous equations, using the substitution method.

$6x + 5y = 116$

$y = 3x - 2$

1

40 Solve the pair of simultaneous equations, using the elimination method.

a $3x + y = 26$
$5x - y = 46$

b $7a + 3b - 36 = 0$
$5a + 2b - 25 = 0$

2

Total marks achieved for PART B /85