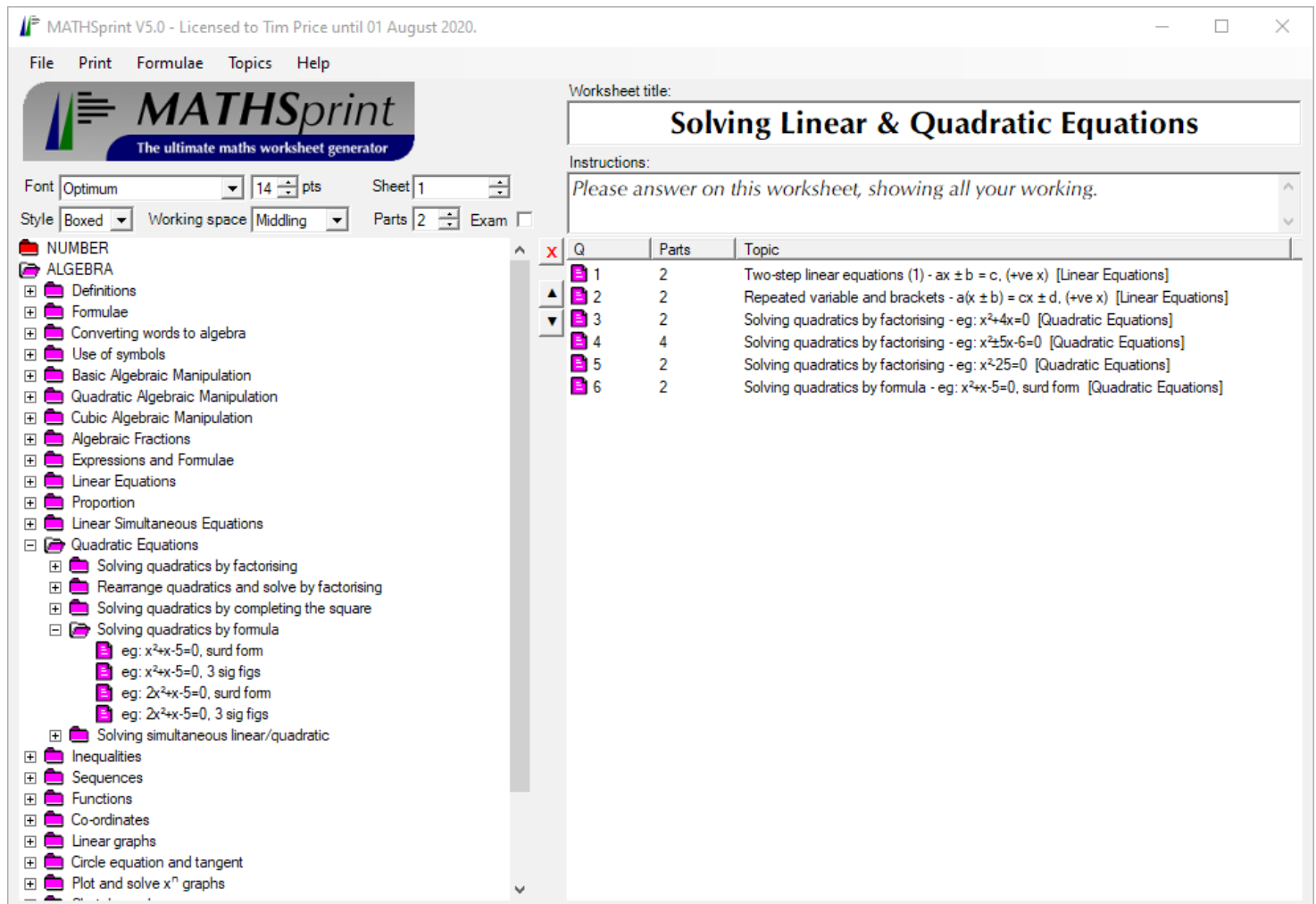


MATHSprint V5.0 HELP SHEET



How to use MATHSprint:

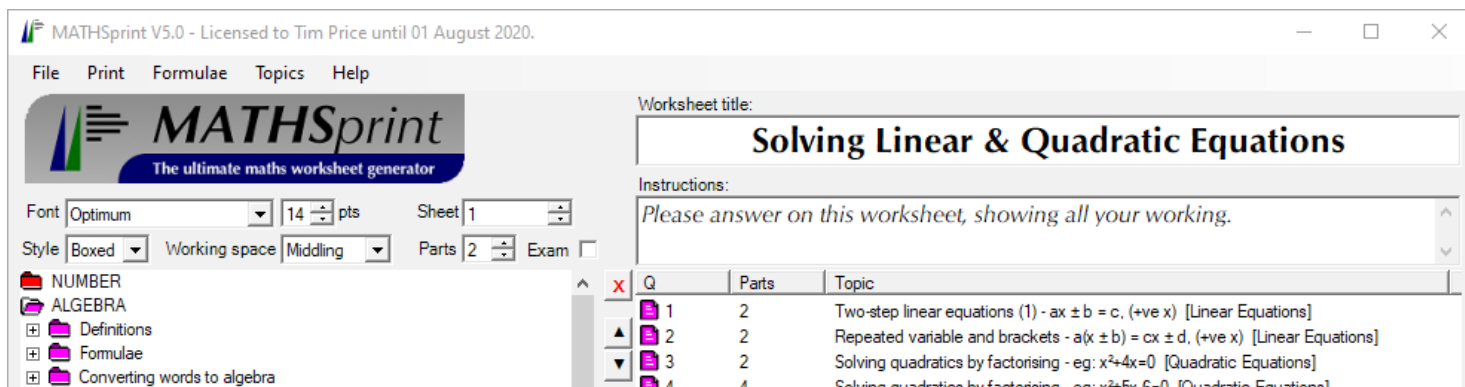
The **left-hand box** contains a **list of all available question topics**, grouped by category. Double-click on any folder to show or hide its contents. When you have found the question you want, double-click it to add it to the right-hand box.

The **right-hand box** is where you **assemble the questions** for your worksheet. You can drag questions up and down to place them in the desired order. Remove topics with the delete key or with the button.

Right-clicking on the number in the 'Parts' column allows you to edit the number of parts per question, or you can use the arrows.

This list of questions is called a **template**, as distinct from the actual printed worksheet which is produced from it.

The **Worksheet title** box is self-explanatory; the **Instructions** box allows you to write any specific information for your pupils.



Menu options:

File

- New** - clear any existing questions ready for a new template.
- Open** - open a previously-created template file.
- Save** - save the current template file (not in demo version).
- Save As** - save the current template file under a new name.
- Exit** - exit *MATHSprint*; you will be prompted to save any changes.

Print

- Page Setup** - edit the page margins, the space between questions and the space between parts of a single question.
- Exam Front Cover Setup** - edit exam cover page headings & rubric.
- Print Preview All** - make a pdf worksheet with questions & answers.
- Print Preview Questions** - make a pdf worksheet with questions only.
- Print Preview Answers** - make a pdf worksheet with answers only.

Formulae - select any formulae to be printed on the worksheet.

Topics

- Find Topic** - search the topic list for a keyword.
- Collapse Topic List** - close all folders in the topic list.
- Expand Topic List** - open all folders in the topic list.

Help

- MATHSprint Help** - display this help file.
- Register MATHSprint** - enter a licence code to enable all features.
- About MATHSprint** - display licence and version information.

Layout options:

Top left of screen:

Font - choose from a selection of 12 different fonts, including three specifically designed for dyslexic students and one for those with visual impairment.

Font size - from 1 to 48 point; 14 is a good size.

Style - **Classic** is the basic question layout, **Ruled** has horizontal lines between questions, **Boxed** has rounded boxes around questions.

Working space - set the space provided on the worksheet for students' working and answers; options range from 'None' to 'Most'.

Sheet - this number is the key to a particular randomised set of questions; change it to get new questions following the same template (e.g. one set in class, another for homework). You can regenerate any sheet on demand by entering the correct sheet number.

Parts - set the default number of parts per question.

Exam - check this box to display an examination cover page and a formula page.

You can create, display and annotate pdf worksheets using a touch screen or interactive board alone - no keyboard needed.

All fonts and symbols now display correctly on all devices and in all browsers and pdf viewers.



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MATHSprint 5.03

Topic List

NUMBER

Definitions

Integer, sum, product, factor, prime, HCF, LCF, prime factor, square number

*Definition to term [9]

*Term to definition [9]

Fractions: equivalent, mixed, improper, proper, numerator, denominator, common denom, reciprocal

*Definition to term [8]

*Term to definition [8]

Decimals: recurring, terminating, irrational, rational, surd, dps, sig figs, standard form

*Definition to term [8]

*Term to definition [8]

Misc. number terms

*Definition to term [25]

*Term to definition [25]

Tables practice

Multiplication tables

*0x

*1x

*2x

*3x

*4x

*5x

*6x

*7x

*8x

*9x

*10x

*11x

*12x

*0x to 5x

*6x to 9x

*0x to 10x

Four operations - basic

Addition

*Addition (+ve to 10)

*Addition ($\pm$ ve to 10)

*Addition (2-digit)

*Addition (3-digit)

*Addition (4-digit)

Subtraction

*(+ve to 10)

*($\pm$ ve to 10)

*(2-digit)

*(3-digit)

*(4-digit)

Multiplication

*(+ve to 10)

*($\pm$ ve to 10)

Division

*Division (+ve to 10)

*Division ($\pm$ ve to 10)

Multiplication methods

Integer multiplication - any method

*2 digit x 2 digit

*3 digit x 2 digit

*4 digit x 2 digit

*3 digit x 3 digit

*4 digit x 3 digit

Decimal multiplication - any method

*2 digit x 2 digit

*3 digit x 2 digit

*4 digit x 2 digit

*3 digit x 3 digit

*4 digit x 3 digit

Long multiplication

*2 digit x 2 digit

*3 digit x 2 digit

*4 digit x 2 digit

*3 digit x 3 digit

*4 digit x 3 digit

Lattice multiplication - integers

*2 digit x 2 digit

*3 digit x 2 digit

*4 digit x 2 digit

*3 digit x 3 digit

*4 digit x 3 digit

*5 digit x 3 digit

*4 digit x 4 digit

*5 digit x 4 digit

*6 digit x 4 digit

*Misc to 3x3 digits

*Misc over 3x3 digits

Lattice multiplication - decimals

*2 digit x 2 digit

*3 digit x 2 digit

*4 digit x 2 digit

*3 digit x 3 digit

*4 digit x 3 digit

*5 digit x 3 digit

*4 digit x 4 digit

*5 digit x 4 digit

*6 digit x 4 digit

*Misc to 3x3 digits

*Misc over 3x3 digits

Grid multiplication - integers

*2 digit x 1 digit

*3 digit x 1 digit

*2 digit x 2 digit

*3 digit x 2 digit

Divisibility tests

Basic

*Divisibility by 2

*Divisibility by 3

*Divisibility by 4

- *Divisibility by 5
- *Divisibility by 6
- *Divisibility by 9
- *Divisibility by 10
- *Divisibility by 2,5,10
- *Divisibility by 2,3,4,5,6,9,10

Medium

- *Divisibility by 8
- *Divisibility by 11
- *Divisibility by 12
- *Divisibility by 15
- *Divisibility by 18
- *Divisibility by 25
- *Divisibility by 8,11,12,15,18,25

Division methods

Integer short division - no remainder

- *3 digit $\div$ 2-5
- *3 digit $\div$ 6-9
- *3 digit $\div$ 2-9
- *4 digit $\div$ 2-5
- *4 digit $\div$ 6-9
- *4 digit $\div$ 2-9
- *5 digit $\div$ 2-5
- *5 digit $\div$ 6-9
- *5 digit $\div$ 2-9
- *6 digit $\div$ 2-5
- *6 digit $\div$ 6-9
- *6 digit $\div$ 2-9

Decimal short division

- *3 digit $\div$ 2-5
- *3 digit $\div$ 6-9
- *3 digit $\div$ 2-9
- *4 digit $\div$ 2-5
- *4 digit $\div$ 6-9
- *4 digit $\div$ 2-9
- *5 digit $\div$ 2-5
- *5 digit $\div$ 6-9
- *5 digit $\div$ 2-9
- *6 digit $\div$ 2-5
- *6 digit $\div$ 6-9
- *6 digit $\div$ 2-9

BIDMAS and Factors

BIDMAS

- *Add/subtract +ve numbers
- *Add/subtract $\pm$ ve numbers
- *Multiply/divide +ve numbers
- *Multiply/divide $\pm$ ve numbers
- *Combined operations 1: +ve numbers
- *Combined operations 1: $\pm$ ve numbers
- *Combined operations 2: +ve numbers
- *Combined operations 2: $\pm$ ve numbers

Factors

- *List all factors
- *Express as product of primes
- *HCF
- *LCM

Fractions

Cancelling down fractions

- *Easy
- *Medium
- *Hard
- *Misc

Equivalent fractions

- *Easy

Converting fractions

- *Top-heavy to mixed
- *Mixed to top-heavy
- *Misc

Adding/subtracting fractions

- *Addition: $\frac{3}{7} + \frac{2}{7}$
- *Subtraction: $\frac{3}{7} - \frac{2}{7}$
- *Add/Sub: $\frac{3}{7} \pm \frac{2}{7}$
- *Addition: $\frac{3}{7} + \frac{2}{21}$
- *Subtraction: $\frac{3}{7} - \frac{2}{21}$
- *Add/Sub: $\frac{3}{7} \pm \frac{2}{21}$
- *Addition: $\frac{1}{2} + \frac{2}{7}$
- *Subtraction: $\frac{1}{2} - \frac{2}{7}$
- *Add/Sub: $\frac{1}{2} \pm \frac{2}{7}$
- *Addition: $\frac{4^3}{7} + \frac{1^2}{21}$
- *Subtraction: $\frac{4^3}{7} - \frac{1^2}{21}$
- *Add/Sub: $\frac{4^3}{7} \pm \frac{1^2}{21}$
- *Addition: $\frac{4^1}{2} + \frac{1^2}{7}$
- *Subtraction: $\frac{4^1}{2} - \frac{1^2}{7}$
- *Add/Sub: $\frac{4^1}{2} \pm \frac{1^2}{7}$

Multiplying/dividing fractions

- *Multiplication: $\frac{1}{2} \times \frac{3}{7}$
- *Division: $\frac{1}{2} \div \frac{3}{7}$
- *Mult/Div: $\frac{1}{2} \times \div \frac{3}{7}$
- *Multiplication: $3\frac{1}{2} \times \frac{3}{7}$
- *Division: $3\frac{1}{2} \div \frac{3}{7}$
- *Mult/Div: $3\frac{1}{2} \times \div \frac{3}{7}$
- *Multiplication: $3\frac{1}{2} \times 2\frac{3}{7}$
- *Division: $3\frac{1}{2} \div 2\frac{3}{7}$
- *Mult/Div: $3\frac{1}{2} \times \div 2\frac{3}{7}$

'Show that' fractions + -

- *Addition: $\frac{3}{7} + \frac{2}{21}$
- *Subtraction: $\frac{3}{7} - \frac{2}{21}$
- *Add/Sub: $\frac{3}{7} \pm \frac{2}{21}$
- *Addition: $\frac{1}{2} + \frac{2}{7}$
- *Subtraction: $\frac{1}{2} - \frac{2}{7}$
- *Add/Sub: $\frac{1}{2} \pm \frac{2}{7}$
- *Addition: $\frac{4^3}{7} + \frac{1^2}{21}$
- *Subtraction: $\frac{4^3}{7} - \frac{1^2}{21}$
- *Add/Sub: $\frac{4^3}{7} \pm \frac{1^2}{21}$
- *Addition: $\frac{4^1}{2} + \frac{1^2}{7}$
- *Subtraction: $\frac{4^1}{2} - \frac{1^2}{7}$
- *Add/Sub: $\frac{4^1}{2} \pm \frac{1^2}{7}$

'Show that' fractions $\times \div$

- *Multiplication: $\frac{1}{2} \times \frac{3}{7}$
- *Division: $\frac{1}{2} \div \frac{3}{7}$
- *Mult/Div: $\frac{1}{2} \times \div \frac{3}{7}$
- *Multiplication: $3\frac{1}{2} \times \frac{3}{7}$
- *Division: $3\frac{1}{2} \div \frac{3}{7}$
- *Mult/Div: $3\frac{1}{2} \times \div \frac{3}{7}$
- *Multiplication: $3\frac{1}{2} \times 2\frac{3}{7}$
- *Division: $3\frac{1}{2} \div 2\frac{3}{7}$

*Mult/Div: $3\frac{1}{2} \times \div 2\frac{3}{7}$

Decimals

Ordering decimals

- *Easy ascending
- *Easy descending
- *Medium ascending
- *Medium descending

Converting

- *Recurring decimal to fraction: 0.222222...
- *Recurring decimal to fraction: 0.232323...
- *Recurring decimal to fraction: 0.234234...
- *Recurring decimal to fraction: 0.9222222...
- *Recurring decimal to fraction: 0.9232323...
- *Recurring decimal to fraction: 0.9234234...

Powers and Roots

Simplify surds

- *Easy square factor, eg: $\sqrt{20}$
- *Harder square factor, eg: $\sqrt{108}$
- * $\sqrt{45} \pm \sqrt{20}$
- * $\sqrt{15} \times \sqrt{5}$
- * $\sqrt{15} / \sqrt{5}$
- * $\sqrt{15} \times \sqrt{5}, \sqrt{15} / \sqrt{5}$
- *Misc basic
- * $\sqrt{3}(2 \pm \sqrt{3})$
- * $\sqrt{3}(2 \pm 5\sqrt{3})$
- * $\sqrt{3}(2 \pm \sqrt{5})$
- * $\sqrt{3}(2 \pm 3\sqrt{5})$
- *Misc expanding 1 bracket
- * $(4 \pm \sqrt{5})^2$
- * $(3 \pm \sqrt{5})(4 \pm \sqrt{5})$
- * $(3 \pm 2\sqrt{5})(4 \pm 3\sqrt{5})$
- *Misc expanding 2 brackets
- * $(3 \pm 2\sqrt{5})(4 \pm 3\sqrt{7})$
- * $(3\sqrt{7} \pm 2\sqrt{5})^2$

Surds - rationalise denominator

- * $2/\sqrt{6}$, etc.
- * $1/(2 \pm \sqrt{5})$, etc.
- * $\pm 4/(2 \pm \sqrt{5})$, etc.
- * $1/(7 \pm 3\sqrt{5})$, etc.
- * $\pm 4/(7 \pm 3\sqrt{5})$, etc.
- * $1/(\sqrt{5} \pm \sqrt{3})$, etc.
- * $1/(\sqrt{5} \pm 3\sqrt{3})$, etc.
- *Misc 1
- * $(2 \pm \sqrt{5})/(3 \pm \sqrt{5})$, etc.
- * $(2 \pm 4\sqrt{5})/(3 \pm 2\sqrt{5})$, etc.
- * $(\sqrt{5} + \sqrt{3})/(\sqrt{5} - \sqrt{3})$, etc.
- * $(\sqrt{5} + 3\sqrt{3})/(\sqrt{5} - 3\sqrt{3})$, etc.
- *Misc 2

Evaluate

- * $\sqrt{64}$, etc. (exact roots)
- * 3^2 , etc. (+ve integer index)
- * 7^0 , etc. (zero integer index)
- * 4^{-3} , etc. (-ve integer index)
- * $3^2, 7^0$, etc. (+ve and zero integer index)
- * $3^2, 4^{-3}$, etc. ($\pm$ ve integer index)
- * $4^{-3}, 7^0$, etc. (-ve and zero integer index)
- * $3^2, 4^{-3}, 7^0$, etc. ($\pm$ ve and zero integer index)
- * $4^{1/2}$, etc. (+ve unit fraction index)

- * $27^{-1/3}$, etc. (-ve unit fraction index)
- * $4^{1/2}, 27^{-1/3}$, etc. ($\pm$ ve unit fraction index)
- * $8^{2/3}$, etc. (+ve non-unit fraction index)
- * $64^{-2/3}$, etc. (-ve non-unit fraction index)
- * $8^{2/3}, 64^{-2/3}$, etc. ($\pm$ ve non-unit fraction index)
- *Misc powers of integers
- * $(1/4)^2$, etc. (+ve integer index)
- * $(1/3)^{-3}$, etc. (-ve integer index)
- * $(1/4)^2, (1/3)^{-3}$, etc. ($\pm$ ve integer index)
- * $(1/4)^{1/2}$, etc. (+ve unit fraction index)
- * $(1/8)^{-1/3}$, etc. (-ve unit fraction index)
- * $(1/4)^{1/2}, (1/8)^{-1/3}$, etc. ($\pm$ ve unit fraction index)
- *Misc powers of fractions

Laws of indices

- *Multiplication
- *Division
- *Brackets
- *Misc

Percentages

Converting

- *Percentage to decimal, eg 17%
- *Decimal to percentage, eg 0.17
- *Misc. between % and decimal, eg 17%
- *Percentage to decimal, eg 1.7%
- *Decimal to percentage, eg 0.017
- *Misc. between % and decimal, eg 1.7%
- *Percentage to fraction, eg 60%
- *Fraction to percentage, eg 3/5
- *Misc. between % and fraction, eg 60%
- *Percentage to fraction, eg 32%
- *Fraction to percentage, eg 8/25
- *Misc. between % and fraction, eg 32%
- *Percentage to fraction, eg 37.5%
- *Fraction to percentage, eg 3/8
- *Misc. between % and fraction, eg 37.5%
- *Arrange %, decimal and fraction into order

Find P% of Y

- *eg: find 40% of 60
- *eg: find 32% of 70
- *eg: find 13.5% of 5.8

Find X as a percentage of Y

- *eg: find 24 as a % of 60
- *eg: find 22.4 as a % of 70
- *eg: find 0.783 as a % of 5.8

Find a number so that P% of it gives X

- *eg: 40% of Y = 24; find Y
- *eg: 32% of Y = 22.4; find Y
- *eg: 13.5% of Y = 0.783; find Y

Increase/decrease by percentage

- *eg: increase 60 by 40%
- *eg: increase 70 by 32%
- *eg: increase 5.8 by 13.5%
- *eg: decrease 60 by 40%
- *eg: decrease 70 by 32%
- *eg: decrease 5.8 by 13.5%
- *eg: increase/decrease 60 by 40%
- *eg: increase/decrease 70 by 32%
- *eg: increase/decrease 5.8 by 13.5%

Find percentage increase/decrease

- *Find % increase (easy)
- *Find % increase (medium)
- *Find % increase (hard)
- *Find % decrease (easy)
- *Find % decrease (medium)
- *Find % decrease (hard)
- *Find % increase/decrease (easy)
- *Find % increase/decrease (medium)
- *Find % increase/decrease (hard)

Compound interest/depreciation

- *Compound interest: new value
- *Compound interest: interest
- *Compound interest: misc
- *Depreciation: remaining value
- *Depreciation: loss
- *Depreciation: misc
- *Compound interest/depreciation

Reverse percentage problem

- *Reverse % problem - pre-sale

Ratios

Manipulation of ratios

- *Cancel down a:b
- *Cancel down a:b:c

Using ratios

- *Sharing 2 ways
- *Sharing 3 ways
- *Sharing 2 or 3 ways
- *Increase
- *Decrease
- *Increase/decrease
- *Increase/decrease/share

Accuracy

Identifying Accuracy

- *Count decimal places
- *Count significant figures

Rounding

- *Round to decimal places
- *Round to significant figures
- *Round to dec places/sig figs

Lower and upper bounds

- *Lower bound
- *Upper bound
- *Lower or upper bound
- *Lower and upper bounds
- *Lower bound, nearest 2 or 5
- *Upper bound, nearest 2 or 5
- *Lower or upper bound, nearest 2 or 5
- *Lower and upper bounds, nearest 2 or 5
- *Give min or max values of calculations

Standard Form

Standard form

- *Verify
- *Convert from [exponent = 0]
- *Convert to [exponent = 0]
- *Convert from [exponent < 0]
- *Convert to [exponent < 0]
- *Convert from [any exponent]

*Convert to [any exponent]

*Multiplication

*Division

*Multiplication/division

*Addition

*Subtraction

*Addition/subtraction

*Misc. calculations

Electronic Calculators

Evaluating expressions

- *+ve numbers
- *±ve numbers

ALGEBRA

Definitions

Equation, expression, identity, formula, inequality

- *Definition to term [5]
- *Term to definition [5]

Expand, simplify, factorise, solve, evaluate

- *Definition to term [5]
- *Term to definition [5]

Term, coefficient, constant, variable, index

- *Definition to term [5]
- *Term to definition [5]

Misc. algebra terms

- *Definition to term [15]
- *Term to definition [15]

Sequences: Arithmetic, quadratic, geometric, Fibonacci

- *Definition to term [4]
- *Term to definition [4]

Function, domain, range, inverse, composite

- *Definition to term [5]
- *Term to definition [5]

Gradient, y-intercept, $y=mx+c$, parallel, perpendicular

- *Definition to term [5]
- *Term to definition [5]

Graphs: parabola, cubic, linear, reciprocal, exponential

- *Definition to term [5]
- *Term to definition [5]

Transformations of graphs: $y=-f(x)$, $y=f(-x)$, $y=f(x)+a$, $y=f(x+a)$

- *Definition to term [4]
- *Term to definition [4]

Formulae

Quadratic formula

- *Definition to term [1]
- *Term to definition [1]

Equation of a circle

- *Definition to term [1]
- *Term to definition [1]

Converting words to algebra

Expressions in one variable

- *Single operation: add/subtract/multiply/divide
- *Single operation: variable combined with itself
- *Single operation: powers/roots/reciprocal/negation
- *Two operations: add/subtract/multiply/divide

Indices

+ve integer indices

* $a \times a \times a$
* $a^2 \times a^3$
* a^3/a^2
* $(a^3)^2$
* $a \times a^3/a^2$
*Misc

±ve integer indices

* $1/(a \times a \times a)$
* $a^2 \times a^{-3}$
* a^3/a^{-2}
* $(a^{-3})^2$
* $a \times a^{-3}/a^2$
*Misc

Simplifying +ve indices (1 variable)

* $6a^2 \times 3a$
* $6a^2/3a$
* $(2a^2)^3$
*Misc +ve 1-var 1
* $(2a^2)^3 \times 3a$
* $(2a^2)^3/3a$
* $6a^2 \times 3a \times 4a^3$
* $6a^2 \times 3a/4a^3$
*Misc +ve 1-var 2

Simplifying +ve indices (2 variables)

* $6a^2b^3 \times 3ab^2$
* $6a^2b^3/3ab^2$
* $(2ab^2)^3$
*Misc +ve 2-var 1

Simplifying ±ve indices (1 variable)

* $6a^2 \times 3a$
* $6a^2/3a$
* $(2a^2)^3$
*Misc ±ve 1-var 1
* $(2a^2)^3 \times 3a$
* $(2a^2)^3/3a$
* $6a^2 \times 3a \times 4a^3$
* $6a^2 \times 3a/4a^3$
*Misc ±ve 1-var 2

Simplifying fractional indices

* $a^{1/3} \times a^{1/2}$
* $a^{1/3}/a^{1/2}$
* $(a^3)^{2/3}$
*Misc fractional

Solving index equations

* $4^n = 16$
* $4^n = 1$
* $4^n = 1/16$
* $4^n = 2$
* $4^n = 1/2$
*Misc $A^n = B$

Basic Algebraic Manipulation

Collecting like +ve terms

* $x + x + x + x$
* $3x + 5x$
* $2x + 4y + 3x + y$
* $2x + 4 + 3x + 1$
* $2x + 4y + 6 + 3x + y + 5$

*Misc. collecting +ve terms 1

* $2x^2 + 4x + 3x^2 + x$
* $2x^2 + 4x + 6 + 3x^2 + x + 5$
* $2xy + 4x + 3yx + x$

*Misc. collecting +ve terms 2

Collecting like ±ve terms

* $3x - 5x$
* $2x + 4y - 3x + y$
* $2x + 4 - 3x + 1$
* $2x + 4y + 6 - 3x + y - 5$
*Misc. collecting ±ve terms 1
* $2x^2 + 4x - 3x^2 + x$
* $2x^2 + 4x + 6 - 3x^2 + x - 5$
* $2xy + 4x + 3yx + x$
*Misc. collecting ±ve terms 2

Expanding over one bracket

* $2(3x \pm 4)$
* $-2(3x \pm 4)$
* $\pm 2(3x \pm 4)$
* $2(3x \pm 4) + 4(7x \pm 1)$
* $2(3x \pm 4) - 4(7x \pm 1)$
* $2(3x \pm 4) \pm 4(7x \pm 1)$
* $\pm 2(3x \pm 4) \pm 4(7x \pm 1)$
*Misc. 1-bracket 1
* $2x(3x - 4)$
* $2x(3x - 4y)$
* $2xy(3x \pm 4y)$
*Misc. 1-bracket 2
* $2x^4y^5(3y \pm 4x^2)$
* $2x^4y^5z^2(3yz^4 \pm 4x^2)$
* $2x^4(3 \pm 4x^2 \pm x)$
* $2x^4y^2(3y^4 \pm 4x^2y^2 \pm x)$
*Misc. 1-bracket 3

Taking out a common factor

* $6x \pm 8$
* $-6x - 8$
* $\pm 6x \pm 8$
* $6x^2 \pm 8x$
* $6x^2 \pm 8xy$
* $6x^2y \pm 8xy^2$
*Misc common factor 1
* $6x^4y^6 \pm 8x^7y^5$
* $6x^4y^6z^5 \pm 8x^7y^5z^2$
* $6x^4 \pm 8x^7 \pm 4x^5$
* $6x^4y^6 \pm 8x^7y^5 \pm 4x^5y^2$
*Misc common factor 2

Quadratic Algebraic Manipulation

Expanding quadratics (a=1)

* $(x + 4)(x + 5)$
* $(x - 4)(x - 5)$
* $(x + 4)(x - 5)$
* $(x - 4)(x + 4)$
* $(x \pm 4)(x \pm 5)$
* $(x \pm 4)^2$

Expanding quadratics (a>1)

* $(3x \pm 7)(5x \pm 8)$
* $(3x \pm 7)^2$
* $7(2x \pm 5)(3x \pm 2)$

$$*-7(2x \pm 5)(3x \pm 2)$$

$$*\pm 7(2x \pm 5)(3x \pm 2)$$

$$*7(2x \pm 5)^2$$

$$*-7(2x \pm 5)^2$$

$$*\pm 7(2x \pm 5)^2$$

Find two numbers with sum and product

*+ve sum, +ve product

*-ve sum, +ve product

*±ve sum, +ve product

*+ve sum, -ve product

*-ve sum, -ve product

*±ve sum, -ve product

*±ve sum, ±ve product

*±ve sum, ±ve product incl 0

Factorising quadratics (a=1)

$$*x^2 \pm 4x$$

$$*x^2 + 5x + 6$$

$$*x^2 - 5x + 6$$

$$*x^2 \pm 5x - 6$$

$$*x^2 \pm 5x \pm 6$$

$$*x^2 \pm 10x + 25$$

$$*x^2 - 25$$

$$*x^2 \pm 4x, x^2 \pm 5x \pm 6, x^2 - 25$$

Factorising quadratics (a>1)

$$*9x^2 - 16$$

$$*9x^2 - 16y^2$$

$$*3x^2 \pm 5x \pm 2$$

Completing the square

*Complete the square $(x+p)^2+q$

*Complete the square $a(x+p)^2+q$

*Find line of symmetry $(x+p)^2+q$

*Find line of symmetry $a(x+p)^2+q$

*Find min/max value $(x+p)^2+q$

*Find min/max value $a(x+p)^2+q$

*Find co-ordinates of vertex $(x+p)^2+q$

*Find co-ordinates of vertex $a(x+p)^2+q$

Cubic Algebraic Manipulation

Expanding three brackets

$$*x(x \pm A)(x \pm B)$$

$$*x(x \pm A)(Bx \pm C)$$

$$*x(Ax \pm B)(Cx \pm D)$$

$$*Misc \text{ up to } x(Ax \pm B)(Cx \pm D)$$

$$*(x \pm A)(x \pm B)(x \pm C)$$

$$*(x \pm A)(x \pm B)(Cx \pm D)$$

$$*(x \pm A)(Bx \pm C)(Dx \pm E)$$

$$*(Ax \pm B)(Cx \pm D)(Ex \pm F)$$

$$*Misc \text{ up to } (Ax \pm B)(Cx \pm D)(Ex \pm F)$$

$$*x(x \pm A)^2$$

$$*x(Ax \pm B)^2$$

$$*Misc \text{ up to } x(Ax \pm B)^2$$

$$*(x \pm A)^2(x \pm B)$$

$$*(x \pm A)^2(Bx \pm C)$$

$$*(Ax \pm B)^2(x \pm C)$$

$$*(Ax \pm B)^2(Cx \pm D)$$

$$*Misc \text{ up to } (Ax \pm B)^2(Cx \pm D)$$

$$*(x \pm A)^3$$

$$*(Ax \pm B)^3$$

$$*Misc \text{ up to } (Ax \pm B)^3$$

$$*Misc (x \pm A)(x \pm B)(x \pm C)$$

$$*Misc (x \pm A)(x \pm B)(Cx \pm D)$$

$$*Misc (x \pm A)(Bx \pm C)(Dx \pm E)$$

$$*Misc (Ax \pm B)(Cx \pm D)(Ex \pm F)$$

Algebraic Fractions

Algebraic fractions - simplify

$$*eg: 2x/6$$

$$*eg: 2(x+2)/6$$

$$*eg: (2x+4)/6$$

$$*eg: (2x+4)/6x$$

$$*eg: (2x+4)/(6x-2)$$

*Numeric common factor

$$*eg: x(x+2)/6x$$

$$*eg: (x^2+2x)/6x$$

$$*eg: x(x+2)/x(x-3)$$

$$*eg: (x^2+2x)/(x^2-3x)$$

$$*eg: (2x^2+4x)/(4x^2-12x)$$

*Algebraic common factor 1

$$*eg: (x+2)(x+1)/(x+2)$$

$$*eg: (x^2+3x+2)/(x+2)$$

$$*eg: (x^2-4)/(x \pm 2)$$

$$*eg: (x^2-4)/(x^2 \pm 2x)$$

$$*eg: (x+2)(x+1)/(x+3)(x+2)$$

$$*eg: (x^2+3x+2)/(x^2+5x+6)$$

*Algebraic common factor 2

Algebraic fractions - add/subtract

$$*eg: 2x/3 \pm x/6$$

$$*eg: 2x/3 \pm x/4$$

$$*eg: 2x/3 \pm 3(x+1)/4$$

$$*eg: (x-1)/3 \pm 2/5$$

$$*eg: 2(x-3)/3 \pm 3(2x+1)/4$$

$$*eg: 2/3x \pm 1/6x$$

$$*eg: 2/x \pm 3/(x+1)$$

$$*eg: 2/(x+1) \pm 3/(x+2)$$

$$*eg: 2x/(2x+1) - x/(x-2)$$

$$*eg: (x+3)/(x+1) - (x-3)/(x-2)$$

Algebraic fractions - multiply/divide 1

$$*eg: 2x/3 \times 6/7x$$

$$*eg: 2x/3 \div 7x/6$$

$$*eg: 2x/3 \times 6/7x \text{ [or divide]}$$

$$*eg: (2x+1)/3 \times 4x/(6x+3)$$

$$*eg: (2x+1)/3 \div (6x+3)/4x$$

$$*eg: (2x+1)/3 \times 4x/(6x+3) \text{ [or divide]}$$

$$*eg: (2x^2+x)/3x \times 4x/(6x+3)$$

$$*eg: (2x^2+x)/3x \div (6x+3)/4x$$

$$*eg: (2x^2+x)/3x \times 4x/(6x+3) \text{ [or divide]}$$

*Misc multiplication

*Misc division

*Misc mult/division

Algebraic fractions - multiply/divide 2

$$*eg: (x^2+3x+2)/3 \times 4/(x+2)$$

$$*eg: (x^2+3x+2)/3 \div (x+2)/4$$

$$*eg: (x^2+3x+2)/3 \times 4/(x+2) \text{ [or divide]}$$

$$*eg: (x^2+3x+2)/3x \times 4x/(x+2)$$

$$*eg: (x^2+3x+2)/3x \div (x+2)/4x$$

$$*eg: (x^2+3x+2)/3x \times 4x/(x+2) \text{ [or divide]}$$

$$*eg: (x^2+3x+2)/3 \times 4/(x^2+5x+6)$$

$$*eg: (x^2+3x+2)/3 \div (x^2+5x+6)/4$$

*eg: $(x^2+3x+2)/3 \times 4/(x^2+5x+6)$ [or divide]
 *eg: $(x^2+3x+2)/3 \times 4x/(x^2+5x+6)$
 *eg: $(x^2+3x+2)/3 \div (x^2+5x+6)/4x$
 *eg: $(x^2+3x+2)/3 \times 4x/(x^2+5x+6)$ [or divide]
 *eg: $(x^2+3x+2)/(x^2+5x+6) \times (x^2+2x-3)/(x^2-3x+2)$
 *eg: $(x^2+3x+2)/(x^2+5x+6) \div (x^2-3x+2)/(x^2+2x-3)$
 *eg: $(x^2+3x+2)/(x^2+5x+6) \times (x^2+2x-3)/(x^2-3x+2)$ [or divide]

*Misc multiplication

*Misc division

*Misc mult/division

Expressions and Formulae

Substituting

*+ve integers

*±ve integers

Rearranging formulae

*1 step (flowchart)

*2 steps (flowchart)

*3 steps (flowchart)

*Rational function

Linear Equations

One-step linear equations

* $x \pm b = c$, (+ve x)

* $x \pm b = c$, (-ve x)

* $x \pm b = c$, (±ve x)

* $ax = c$, (+ve x)

* $ax = c$, (-ve x)

* $ax = c$, (±ve x)

* $x/d = c$, (+ve x)

* $x/d = c$, (-ve x)

* $x/d = c$, (±ve x)

*Misc (+ve x)

*Misc (-ve x)

*Misc (±ve x)

Two-step linear equations (1)

* $ax \pm b = c$, (+ve x)

* $ax \pm b = c$, (-ve x)

* $ax \pm b = c$, (±ve x)

* $x/d \pm b = c$, (+ve x)

* $x/d \pm b = c$, (-ve x)

* $x/d \pm b = c$, (±ve x)

* $a(x \pm b) = c$, (+ve x)

* $a(x \pm b) = c$, (-ve x)

* $a(x \pm b) = c$, (±ve x)

* $(x \pm b)/d = c$, (+ve x)

* $(x \pm b)/d = c$, (-ve x)

* $(x \pm b)/d = c$, (±ve x)

*Misc (+ve x)

*Misc (-ve x)

*Misc (±ve x)

Two-step linear equations (2)

* $b - ax = c$, (+ve x)

* $b - ax = c$, (-ve x)

* $b - ax = c$, (±ve x)

* $b - x/d = c$, (+ve x)

* $b - x/d = c$, (-ve x)

* $b - x/d = c$, (±ve x)

* $a/x \pm b = c$, (+ve x)

* $a/x \pm b = c$, (-ve x)

* $a/x \pm b = c$, (±ve x)

*Misc (+ve x)

*Misc (-ve x)

*Misc (±ve x)

Repeated variable

* $ax = cx \pm d$, (+ve x)

* $ax = cx \pm d$, (-ve x)

* $ax = cx \pm d$, (±ve x)

* $ax \pm b = cx \pm d$, (+ve x)

* $ax \pm b = cx \pm d$, (-ve x)

* $ax \pm b = cx \pm d$, (±ve x)

*Misc (+ve x)

*Misc (-ve x)

*Misc (±ve x)

Repeated variable and brackets

* $a(x \pm b) = cx \pm d$, (+ve x)

* $a(x \pm b) = cx \pm d$, (-ve x)

* $a(x \pm b) = cx \pm d$, (±ve x)

* $a(x \pm b) = c(x \pm d)$, (+ve x)

* $a(x \pm b) = c(x \pm d)$, (-ve x)

* $a(x \pm b) = c(x \pm d)$, (±ve x)

* $a(x \pm b) + c(x \pm d) = e$, (+ve x)

* $a(x \pm b) + c(x \pm d) = e$, (-ve x)

* $a(x \pm b) + c(x \pm d) = e$, (±ve x)

* $a(x \pm b) - c(x \pm d) = e$, (+ve x)

* $a(x \pm b) - c(x \pm d) = e$, (-ve x)

* $a(x \pm b) - c(x \pm d) = e$, (±ve x)

*Misc (+ve x)

*Misc (-ve x)

*Misc (±ve x)

Repeated variable and division

* $x \pm b = (cx \pm d)/a$, (+ve x)

* $x \pm b = (cx \pm d)/a$, (-ve x)

* $x \pm b = (cx \pm d)/a$, (±ve x)

* $(x \pm b)/a = (x \pm d)/c$, (+ve x)

* $(x \pm b)/a = (x \pm d)/c$, (-ve x)

* $(x \pm b)/a = (x \pm d)/c$, (±ve x)

* $a/(x \pm b) = c/(x \pm d)$, (+ve x)

* $a/(x \pm b) = c/(x \pm d)$, (-ve x)

* $a/(x \pm b) = c/(x \pm d)$, (±ve x)

*Misc (+ve x)

*Misc (-ve x)

*Misc (±ve x)

Proportion

Finding k

*Direct proportion

*Inverse proportion

*Misc proportion

Finding equation

*Direct proportion

*Inverse proportion

*Misc proportion

Solving

*Direct proportion

*Inverse proportion

*Misc proportion

Linear Simultaneous Equations

Linear sim eqn, integer, no multiply

* $2x+3y=7$, $4x+3y=11$ (+ve x,y)

* $2x+3y=7$, $4x-3y=11$ (+ve x,y)

* $2x+3y=7$, $4x\pm 3y=11$ (+ve x,y)

* $2x+3y=7$, $4x+3y=11$ ($\pm$ ve x,y)

* $2x+3y=7$, $4x-3y=11$ ($\pm$ ve x,y)

* $2x+3y=7$, $4x\pm 3y=11$ ($\pm$ ve x,y)

Linear sim eqn, integer, multiply one equation $\times 2$ or $\times 3$

* $2x+y=5$, $3x+2y=8$ (+ve x,y)

* $2x+y=5$, $3x-2y=4$ (+ve x,y)

* $2x+y=5$, $3x\pm 2y=4$ (+ve x,y)

* $2x+y=5$, $3x+2y=8$ ($\pm$ ve x,y)

* $2x+y=5$, $3x-2y=4$ ($\pm$ ve x,y)

* $2x+y=5$, $3x\pm 2y=4$ ($\pm$ ve x,y)

Linear sim eqn, integer, multiply one equation $\times 4$ or more

* $2x+y=5$, $3x+4y=10$ (+ve x,y)

* $2x+y=5$, $3x-4y=2$ (+ve x,y)

* $2x+y=5$, $3x\pm 4y=2$ (+ve x,y)

* $2x+y=5$, $3x+4y=10$ ($\pm$ ve x,y)

* $2x+y=5$, $3x-4y=2$ ($\pm$ ve x,y)

* $2x+y=5$, $3x\pm 4y=2$ ($\pm$ ve x,y)

Linear sim eqn, integer, multiply both equations

* $2x+3y=7$, $3x+4y=10$ (+ve x,y)

* $2x+3y=7$, $3x-4y=2$ (+ve x,y)

* $2x+3y=7$, $3x\pm 4y=2$ (+ve x,y)

* $2x+3y=7$, $3x+4y=10$ ($\pm$ ve x,y)

* $2x+3y=7$, $3x-4y=2$ ($\pm$ ve x,y)

* $2x+3y=7$, $3x\pm 4y=2$ ($\pm$ ve x,y)

Linear sim eqn, (half)-integer, no multiply

* $2x+3y=7$, $4x+3y=11$ (+ve x,y)

* $2x+3y=7$, $4x-3y=11$ (+ve x,y)

* $2x+3y=7$, $4x\pm 3y=11$ (+ve x,y)

* $2x+3y=7$, $4x+3y=11$ ($\pm$ ve x,y)

* $2x+3y=7$, $4x-3y=11$ ($\pm$ ve x,y)

* $2x+3y=7$, $4x\pm 3y=11$ ($\pm$ ve x,y)

Linear sim eqn, (half)-integer, multiply one equation $\times 2$ or $\times 3$

* $2x+y=5$, $3x+2y=8$ (+ve x,y)

* $2x+y=5$, $3x-2y=4$ (+ve x,y)

* $2x+y=5$, $3x\pm 2y=4$ (+ve x,y)

* $2x+y=5$, $3x+2y=8$ ($\pm$ ve x,y)

* $2x+y=5$, $3x-2y=4$ ($\pm$ ve x,y)

* $2x+y=5$, $3x\pm 2y=4$ ($\pm$ ve x,y)

Linear sim eqn, (half)-integer, multiply one equation $\times 4$ or more

* $2x+y=5$, $3x+4y=10$ (+ve x,y)

* $2x+y=5$, $3x-4y=2$ (+ve x,y)

* $2x+y=5$, $3x\pm 4y=2$ (+ve x,y)

* $2x+y=5$, $3x+4y=10$ ($\pm$ ve x,y)

* $2x+y=5$, $3x-4y=2$ ($\pm$ ve x,y)

* $2x+y=5$, $3x\pm 4y=2$ ($\pm$ ve x,y)

Linear sim eqn, (half)-integer, multiply both equations

* $2x+3y=7$, $3x+4y=10$ (+ve x,y)

* $2x+3y=7$, $3x-4y=2$ (+ve x,y)

* $2x+3y=7$, $3x\pm 4y=2$ (+ve x,y)

* $2x+3y=7$, $3x+4y=10$ ($\pm$ ve x,y)

* $2x+3y=7$, $3x-4y=2$ ($\pm$ ve x,y)

* $2x+3y=7$, $3x\pm 4y=2$ ($\pm$ ve x,y)

Quadratic Equations

Solving quadratics by factorising

*eg: $(x+2)(x+3)=0$

*eg: $x(x+4)=0$

*eg: $x^2+4x=0$

*eg: $x^2+5x+6=0$

*eg: $x^2-5x+6=0$

*eg: $x^2\pm 5x-6=0$

*eg: $x^2\pm 5x\pm 6=0$

*eg: $x^2+10x+25=0$

*eg: $x^2-25=0$

*Misc $x^2\pm Ax\pm B=0$

*eg: $3x^2-7x+2=0$

Rearrange quadratics and solve by factorising

*eg: $(x-1)(x+2) = 4$

*eg: $x + 6/x = 5$, etc.

*eg: $x - 4/(x+2) = 1$, etc.

*eg: $3/(x+7) - 3/(x+9) = 2$, etc.

Solving quadratics by completing the square

* $(x+p)^2 + q$

* $a(x+p)^2 + q$

Solving quadratics by formula

*eg: $x^2+x-5=0$, surd form

*eg: $x^2+x-5=0$, 3 sig figs

*eg: $2x^2+x-5=0$, surd form

*eg: $2x^2+x-5=0$, 3 sig figs

Simultaneous linear/quadratic - elimination

*eg: $y=x^2$, $y=2x+3$

*eg: $y=x^2+7x+9$, $y=2x+3$

*Misc

Simultaneous linear/quadratic - substitution

* $xy = k$, $x + ny = p$

* $ax^2 + by^2 = k$, $x + ny = p$

* $ax^2 - by^2 = k$, $x + ny = p$

* $ax^2 \pm bxy = k$, $x + ny = p$

* $ax^2 \pm bxy + cy^2 = k$, $x + ny = p$

* $ax^2 \pm bxy - cy^2 = k$, $x + ny = p$

*Misc

Inequalities

Inequalities on number lines

*Plotting $x < 3$, $x > -2$

*Plotting $x \leq 3$, $x \geq -2$

*Plotting $x < \leq 3$, $x > \geq -2$

*Plotting $-4 < x \leq 3$

*Plotting $x \leq -4$ or $x > 3$

*Plotting misc

*Reading off $x < 3$, $x > -2$

*Reading off $x \leq 3$, $x \geq -2$

*Reading off $x < \leq 3$, $x > \geq -2$

*Reading off $-4 < x \leq 3$

*Reading off $x \leq -4$ or $x > 3$

*Reading off misc

Solving linear inequalities (+ve x coeff)

* $x \pm b < c$, $x \pm b > c$

* $ax < c$, $ax > c$

* $ax \pm b < c$, $ax \pm b > c$

* $a(x \pm b) < c$, $a(x \pm b) > c$

*Misc

Solving linear inequalities (-ve x coeff)

- * $-x \pm b < c$, $-x \pm b > c$
- * $-ax < c$, $-ax > c$
- * $-ax \pm b < c$, $-ax \pm b > c$
- * $-a(x \pm b) < c$, $-a(x \pm b) > c$
- *Misc

Solving linear inequalities ($\pm$ ve x coeff)

- * $\pm x \pm b < c$, $\pm x \pm b > c$
- * $\pm ax < c$, $\pm ax > c$
- * $\pm ax \pm b < c$, $\pm ax \pm b > c$
- * $\pm a(x \pm b) < c$, $\pm a(x \pm b) > c$
- *Misc

Solving linear inequalities and plotting (+ve x coeff)

- * $x \pm b < c$, $x \pm b > c$
- * $ax < c$, $ax > c$
- * $ax \pm b < c$, $ax \pm b > c$
- * $a(x \pm b) < c$, $a(x \pm b) > c$
- *Misc

Solving linear inequalities and plotting (-ve x coeff)

- * $-x \pm b < c$, $-x \pm b > c$
- * $-ax < c$, $-ax > c$
- * $-ax \pm b < c$, $-ax \pm b > c$
- * $-a(x \pm b) < c$, $-a(x \pm b) > c$
- *Misc

Solving linear inequalities and plotting ($\pm$ ve x coeff)

- * $\pm x \pm b < c$, $\pm x \pm b > c$
- * $\pm ax < c$, $\pm ax > c$
- * $\pm ax \pm b < c$, $\pm ax \pm b > c$
- * $\pm a(x \pm b) < c$, $\pm a(x \pm b) > c$
- *Misc

Regions on (x,y) plane

- *Shade out a region $y < c$ or $y > c$
- *Identify an inequality $y < c$ or $y > c$
- *Shade out a region $x < c$ or $x > c$
- *Identify an inequality $x < c$ or $x > c$
- *Shade out a region $y < mx + c$ (integer m)
- *Identify an inequality $y < mx + c$ (integer m)
- *Shade out a region $y < mx + c$ (integer m) or $x < c$ or

$y < c$

- *Identify an inequality $y < mx + c$ (integer m) or $x < c$ or

$y < c$

- *Shade out a region $y < mx + c$ (rational m)
- *Identify an inequality $y < mx + c$ (rational m)
- *Misc shade out a region
- *Misc identify a shaded region
- *Shade out two inequalities $x < c$ $y < d$
- *Identify two inequalities $x < c$ $y < d$
- *Shade out two inequalities $y < mx + c$ $x/y < d$
- *Identify two inequalities $y < mx + c$ $x/y < d$

Quadratic inequalities

- *Solve algebraically, eg $x^2 > 4$
- *Solve algebraically, eg $2x^2 + 4 < 22$
- *Solve and show on number line, eg $x^2 > 4$
- *Solve and show on number line, eg $2x^2 + 4 < 22$
- *List integer solutions, eg $x^2 > 4$
- *List integer solutions, eg $2x^2 + 4 < 22$

Mathematical proof

Algebra toolkit for proof

- *Specify even, odd numbers, multiples, etc. [10]
- *Specify consecutives, even/odd squares, etc. [12]
- *Specify one more than/twice a square number, etc.

[10]

- *Find simple sums and products, etc. [11]
- *Find sums/differences of squares, cubes, etc. [10]
- *How to prove even, odd, remainder, positive, etc.

[13]

Find a counterexample

- *Primes, factors, inequalities [11]
- *Formulae for primes, squares, cubes [11]
- *Quadrilateral facts [10]

Algebraic proof

- *Combining evens and odds [14]
- *Multiples and remainders [15]
- *Primes, factors, inequalities [11]
- *Formulae for primes, squares, cubes [12]
- *Quadrilateral facts [10]
- *Algebraic exhaustion, factorials [8]
- *Completing the square
- *Misc proof

True or false?

- *Primes, factors, inequalities
- *Formulae for primes, squares, cubes
- *Quadrilateral facts

Sequences

Find the next terms

- *Linear sequence, +ve terms
- *Linear sequence, $\pm$ ve terms
- *Linear sequence, $\pm$ ve decimal terms
- *Quadratic sequence, +ve terms
- *Quadratic sequence, $\pm$ ve terms
- *Geometric sequence, integer terms
- *Geometric sequence, incl. fractional terms
- *Squares, primes, etc. [5]
- *Misc

Use term-to-term rule

- *Add a constant (+ve terms)
- *Add a constant (-ve terms)
- *Add a constant ($\pm$ ve terms)
- *Subtract a constant (+ve terms)
- *Subtract a constant (-ve terms)
- *Subtract a constant ($\pm$ ve terms)
- *Multiply by a fixed ratio (+ve terms)
- *Multiply by a fixed ratio (-ve terms)
- *Multiply by a fixed ratio ($\pm$ ve terms)
- *Multiply then add/subtract (+ve terms)
- *Multiply then add/subtract (-ve terms)
- *Multiply then add/subtract ($\pm$ ve terms)
- *Add/subtract then multiply (+ve terms)
- *Add/subtract then multiply (-ve terms)
- *Add/subtract then multiply ($\pm$ ve terms)
- *Misc add/subtract/multiply (+ve terms)
- *Misc add/subtract/multiply (-ve terms)
- *Misc add/subtract/multiply ($\pm$ ve terms)
- *Square then add/subtract
- *Add/subtract then square
- *Misc add/subtract/multiply/square ($\pm$ ve terms)

Use position-to-term formula

- *Linear sequence, +ve terms
- *Linear sequence, $\pm$ ve terms
- *Quadratic sequence, +ve terms
- *Quadratic sequence, $\pm$ ve terms
- *Geometric sequence, integer terms
- *Geometric sequence, incl. fractional terms
- *Squares, cubes, triangle [3]
- *Misc

Solve position-to-term formula

- *Linear sequence, +ve terms
- *Linear sequence, $\pm$ ve terms
- *Quadratic sequence, +ve terms
- *Quadratic sequence, $\pm$ ve terms
- *Geometric sequence, integer terms
- *Geometric sequence, incl. fractional terms
- *Squares, cubes, triangle [3]
- *Misc

Find the position-to-term formula

- *Linear sequence, +ve terms
- *Linear sequence, $\pm$ ve terms
- *Linear sequence, $\pm$ ve decimal terms
- *Quadratic sequence, +ve terms
- *Quadratic sequence, $\pm$ ve terms
- *Geometric sequence, integer terms
- *Geometric sequence, incl. fractional terms
- *Squares, cubes, triangle [3]
- *Misc

Functions

Evaluate $f(a)$

- *1 step
- *2 steps with x^2
- *2 steps with $\sqrt{x}$
- *2 steps with $x^2, \sqrt{x}$
- *3 steps with x^2
- *3 steps with $\sqrt{x}$
- *3 steps with $x^2, \sqrt{x}$
- *Rational function 1
- *Rational function 2
- *Rational function $1/2$
- *Misc

Solve $f(x)=a$

- *1 step
- *2 steps with x^2
- *2 steps with $\sqrt{x}$
- *2 steps with $x^2, \sqrt{x}$
- *3 steps with x^2
- *3 steps with $\sqrt{x}$
- *3 steps with $x^2, \sqrt{x}$
- *Rational function 1
- *Rational function 2
- *Rational function $1/2$
- *Misc

Inverse: evaluate $f^{-1}(a)$

- *1 step
- *2 steps with x^2
- *2 steps with $\sqrt{x}$
- *2 steps with $x^2, \sqrt{x}$

*3 steps with x^2

*3 steps with $\sqrt{x}$

*3 steps with $x^2, \sqrt{x}$

*Rational function 1

*Rational function 2

*Rational function $1/2$

*Misc

Inverse: find $f^{-1}(x)$

- *1 step (flowchart)
- *2 steps (flowchart)
- *3 steps (flowchart)
- *Misc. (flowchart)
- *Rational function
- *Misc.

Domain and range

- *Domain: reciprocal $f(x)$
- *Domain: square root $f(x)$
- *Domain: misc $f(x)$
- *Domain exclusions: reciprocal $f(x)$
- *Domain exclusions: square root $f(x)$
- *Domain exclusions: misc $f(x)$

Composition: find $ff^{-1}(x), fg(x)$

- *Find $ff^{-1}(a)$
- *Find $fg(a)$ (linear/linear)
- *Find $fg(a)$ (linear/quadratic)
- *Find $fg(a)$ (lin/lin or lin/quad)
- *Find $ff^{-1}(x)$
- *Find $fg(x)$ (linear/linear)
- *Find $fg(x)$ (linear/quadratic)
- *Find $fg(x)$ (lin/lin or lin/quad)

Co-ordinates

Basic 2D co-ordinates

- *Plot in one quadrant
- *Identify in one quadrant
- *Plot in four quadrants (large)
- *Identify in four quadrants (large)
- *Plot in four quadrants (small)
- *Identify in four quadrants (small)

Find missing vertices

- *Identify the missing vertex in a square (1)
- *Identify the missing vertex in a square (2)
- *Identify two missing vertices in a square (adjacent)
- *Identify two missing vertices in a square (diagonal)

Line segments

Line segments in the positive quadrant

- *Gradient
- *Mid-point
- *Length
- *Gradient and mid-point
- *Gradient, mid-point & length

Line segments in any quadrant

- *Gradient
- *Mid-point
- *Length
- *Gradient and mid-point
- *Gradient, mid-point & length

Features of linear graphs

Gradient and y-intercept from $y = mx + c$

- *Identify integer gradient
- *Identify integer y-intercept
- *Identify integer gradient and y-intercept
- *Identify fractional gradient
- *Identify fractional y-intercept
- *Identify fractional gradient and y-intercept

Find x-intercept from $y = mx + c$

- *Identify integer x-intercept
- *Identify fractional x-intercept

Converting between $y = mx + c$ and $ax + by + c = 0$

- *Rewrite integer $y = mx + c$ as $ax + by + c = 0$
- *Rewrite fractional $y = mx + c$ as $ax + by + c = 0$
- *Rewrite $ax + by + c = 0$ as integer $y = mx + c$
- *Rewrite $ax + by + c = 0$ as fractional $y = mx + c$

Gradient and y-intercept from $ax + by + c = 0$

- *Identify integer gradient
- *Identify integer y-intercept
- *Identify integer gradient and y-intercept
- *Identify fractional gradient
- *Identify fractional y-intercept
- *Identify fractional gradient and y-intercept

Find x-intercept from $ax + by + c = 0$

- *Identify integer x-intercept
- *Identify fractional x-intercept

Find the equation of a linear graph

Find equation given gradient m and one point

- *Integer m ; $y = mx + c$
- *Integer m ; $ax + by + c = 0$
- *Fractional m ; $y = mx + c$
- *Fractional m ; $ax + by + c = 0$

Find equation given two points

- *Integer m ; $y = mx + c$
- *Integer m ; $ax + by + c = 0$
- *Fractional m ; $y = mx + c$
- *Fractional m ; $ax + by + c = 0$

Parallel and perpendicular lines

Test if lines are parallel, perpendicular or neither

- *Parallel or not: $y = mx + c$, $y = nx + d$
- *Parallel or not: $ax + by + c = 0$, $dx + ey + f = 0$
- *Parallel or not: $y = mx + c$, $ax + by + c = 0$
- *Parallel or not: misc equations
- *Perpendicular or not: $y = mx + c$, $y = nx + d$
- *Perpendicular or not: $ax + by + c = 0$, $dx + ey + f = 0$
- *Perpendicular or not: $y = mx + c$, $ax + by + c = 0$
- *Perpendicular or not: misc equations
- *Parallel, perpendicular or neither: $y = mx + c$, $y = nx + d$

d

*Parallel, perpendicular or neither: $ax + by + c = 0$, $dx + ey + f = 0$

*Parallel, perpendicular or neither: $y = mx + c$, $ax + by + c = 0$

*Parallel, perpendicular or neither: misc equations

Give the equation of a parallel or perpendicular line through a point

- *Parallel line as $y = mx + c$
- *Parallel line as $ax + by + c = 0$
- *Perpendicular line as $y = mx + c$
- *Perpendicular line as $ax + by + c = 0$

- *Parallel/perpendicular line as $y = mx + c$
 - *Parallel/perpendicular line as $ax + by + c = 0$
- Find the perpendicular bisector of a line segment
- *Perpendicular bisector as $y = mx + c$
 - *Perpendicular bisector as $ax + by + c = 0$

Plotting linear graphs

Identify/sketch linear graphs

- *Identify $x = \dots$ or $y = \dots$
- *Sketch $x = \dots$ or $y = \dots$
- *Identify $y = mx + c$ (+ve integer m)
- *Sketch $y = mx + c$ (+ve integer m)
- *Identify $y = mx + c$ (-ve integer m)
- *Sketch $y = mx + c$ (-ve integer m)
- *Identify $y = mx + c$ ($\pm$ ve integer m)
- *Sketch $y = mx + c$ ($\pm$ ve integer m)
- *Identify $y = mx + c$ ($\pm$ ve integer m) or $x = c$, $y = c$
- *Sketch $y = mx + c$ ($\pm$ ve integer m) or $x = c$, $y = c$
- *Identify $y = mx + c$ (+ve rational m)
- *Sketch $y = mx + c$ (+ve rational m)
- *Identify $y = mx + c$ (-ve rational m)
- *Sketch $y = mx + c$ (-ve rational m)
- *Identify $y = mx + c$ ($\pm$ ve rational m)
- *Sketch $y = mx + c$ ($\pm$ ve rational m)
- *Identify misc straight line graph
- *Sketch misc straight line graph

Circle equation and tangent

Give the equation of a circle

- *Centre O , radius r
- *Centre (a, b) , radius r
- *Centre O passing through given point
- *Centre (a, b) passing through given point
- *With given diameter

Give information about a circle

- *Radius of a circle centre O
- *Radius and centre of a circle

Radius of a circle

- *Gradient of radius
- *Equation of radius

Tangent to a circle

- *Gradient of tangent
- *Equation of tangent

Plot and solve x^n graphs

Plot a graph from a table of values

- *Linear graph
- *+ve quadratic graph
- *+ve cubic graph
- *+ve reciprocal graph
- *+ve reciprocal squared graph
- *Misc +ve graph from values
- * $\pm$ ve quadratic graphs
- * $\pm$ ve cubic graph
- * $\pm$ ve reciprocal graph
- * $\pm$ ve reciprocal squared graph
- *Misc $\pm$ ve graph from values

Complete a table of values

- *Linear function
- *+ve quadratic function
- *+ve cubic function

- *+ve reciprocal function
- *+ve reciprocal squared function
- *Misc +ve function
- *±ve quadratic function
- *±ve cubic function
- *±ve reciprocal function
- *±ve reciprocal squared function
- *Misc ±ve function

Complete a table and plot a graph

- *Linear function
- *+ve quadratic function
- *+ve cubic function
- *+ve reciprocal function
- *+ve reciprocal squared function
- *Misc +ve function
- *±ve quadratic function
- *±ve cubic function
- *±ve reciprocal function
- *±ve reciprocal squared function
- *Misc ±ve function

Find gradient of a given graph using a tangent

- *+ve quadratic graph
- *+ve cubic graph
- *+ve reciprocal graph
- *+ve reciprocal squared graph
- *Misc +ve graph
- *±ve quadratic graph
- *±ve cubic graph
- *±ve reciprocal graph
- *±ve reciprocal squared graph
- *Misc ±ve graph

Plot a graph and find gradient using a tangent

- *+ve quadratic graph
- *+ve cubic graph
- *+ve reciprocal graph
- *+ve reciprocal squared graph
- *Misc +ve graph
- *±ve quadratic graph
- *±ve cubic graph
- *±ve reciprocal graph
- *±ve reciprocal squared graph
- *Misc ±ve graph

Solve $f(x)=k$ using a given graph

- *+ve quadratic graph
- *+ve cubic graph
- *+ve reciprocal graph
- *+ve reciprocal squared graph
- *Misc ±ve graph
- *±ve quadratic graph
- *±ve cubic graph
- *±ve reciprocal graph
- *±ve reciprocal squared graph
- *Misc ±ve graph

Plot a graph and solve $f(x)=k$

- *+ve quadratic graph
- *+ve cubic graph
- *+ve reciprocal graph
- *+ve reciprocal squared graph

- *Misc +ve graph
- *±ve quadratic graph
- *±ve cubic graph
- *±ve reciprocal graph
- *±ve reciprocal squared graph
- *Misc ±ve graph

Solve $f(x)=mx+c$ using a given graph

- *+ve quadratic graph
- *+ve cubic graph
- *+ve reciprocal graph
- *+ve reciprocal squared graph
- *Misc +ve graph
- *±ve quadratic graph
- *±ve cubic graph
- *±ve reciprocal graph
- *±ve reciprocal squared graph
- *Misc ±ve graph

Solve $f(x)=mx+c$ (rearranged) using a given graph

- *+ve quadratic graph
- *+ve cubic graph
- *+ve reciprocal graph
- *+ve reciprocal squared graph
- *Misc +ve graph
- *±ve quadratic graph
- *±ve cubic graph
- *±ve reciprocal graph
- *±ve reciprocal squared graph
- *Misc ±ve graph

Sketch graphs

Identify a graph

- * $y=x, x^2, x^3$ [3]
- * $y=1/x, 1/x^2$ [2]
- * $y=x, x^2, x^3, 1/x, 1/x^2$ [5]
- * $y=\sqrt{x}, \sqrt[3]{x}$ [2]
- * $y=k^x: 0 < k < 1, k > 1$ [2]
- *Non-trig graph [9]
- * $y=\sin x, \cos x, \tan x$ [3]

Sketch a graph

- * $y=x, x^2, x^3$ [3]
- * $y=1/x, 1/x^2$ [2]
- * $y=x, x^2, x^3, 1/x, 1/x^2$ [5]
- * $y=\sqrt{x}, \sqrt[3]{x}$ [2]
- * $y=k^x: 0 < k < 1, k > 1$ [2]
- *Non-trig graph [9]
- * $y=\sin x, \cos x, \tan x$ [3]

Sketch a quadratic graph

- * $y = (x+p)^2+q$
- * $y = a(x+p)^2+q$
- * $y = x^2 + bx + c$
- * $y = ax^2 + bx + c$

Suggest a quadratic equation from a sketch graph

- * $y = (x+p)^2+q$
- * $y = a(x+p)^2+q$
- * $y = x^2 + bx + c$
- * $y = ax^2 + bx + c$

Sketch a factorised cubic

- * $y = (x + 3)(x - 2)(x - 4)$, etc.
- * $y = -(x + 3)(x - 2)(x - 4)$, etc.

- * $y = (x + 3)^2(x - 2)$, etc.
- * $y = -(x + 3)^2(x - 2)$, etc.
- * $y = (x + 3)^3$, etc.
- * $y = -(x + 3)^3$, etc.
- *Misc cubic

Suggest a factorised equation for a cubic from a sketch graph

- * $y = (x + 3)(x - 2)(x - 4)$, etc.
- * $y = -(x + 3)(x - 2)(x - 4)$, etc.
- * $y = (x + 3)^2(x - 2)$, etc.
- * $y = -(x + 3)^2(x - 2)$, etc.
- * $y = (x + 3)^3$, etc.
- * $y = -(x + 3)^3$, etc.
- *Misc cubic

Transform graphs

Translation

- *Translate: given $f(x) = x^n$, find $f(x \pm k)$
- *Translate: given $f(x) = x^n$, sketch $f(x \pm k)$
- *Translate $f(x) = x^n$ given a translation vector
- *Translate: transform a point on $y = f(x)$ to $y = f(x \pm k)$

Reflection

- *Reflect: given $f(x) = x^n$, find $-f(x)$ or $f(-x)$
- *Reflect: given $f(x) = x^n$, sketch $-f(x)$ or $f(-x)$
- *Reflect $f(x) = x^n$ given a reflection line
- *Reflect: transform a point on $y = f(x)$ to $y = -f(x)$ or $f(-x)$

x)

Translation or reflection

- *Misc: given $f(x) = x^n$, find $f(x \pm k)$, $-f(x)$ or $f(-x)$
- *Misc: given $f(x) = x^n$, sketch $f(x \pm k)$, $-f(x)$ or $f(-x)$
- *Misc translate or reflect $f(x) = x^n$
- *Misc: translate or reflect a point on $y = f(x)$

- *Percentage to decimal, eg 17%
- *Decimal to percentage, eg 0.17
- *Misc. between % and decimal, eg 17%
- *Percentage to decimal, eg 1.7%
- *Decimal to percentage, eg 0.017
- *Misc. between % and decimal, eg 1.7%
- *Percentage to fraction, eg 60%
- *Fraction to percentage, eg 3/5
- *Misc. between % and fraction, eg 60%
- *Percentage to fraction, eg 32%
- *Fraction to percentage, eg 8/25
- *Misc. between % and fraction, eg 32%
- *Percentage to fraction, eg 37.5%
- *Fraction to percentage, eg 3/8
- *Misc. between % and fraction, eg 37.5%
- *Arrange %, decimal and fraction into order

Find P% of Y

- *eg: find 40% of 60
- *eg: find 32% of 70
- *eg: find 13.5% of 5.8

Find X as a percentage of Y

- *eg: find 24 as a % of 60
- *eg: find 22.4 as a % of 70
- *eg: find 0.783 as a % of 5.8

Find a number so that P% of it gives X

- *eg: 40% of $Y = 24$; find Y
- *eg: 32% of $Y = 22.4$; find Y
- *eg: 13.5% of $Y = 0.783$; find Y

Increase/decrease by percentage

- *eg: increase 60 by 40%
- *eg: increase 70 by 32%
- *eg: increase 5.8 by 13.5%
- *eg: decrease 60 by 40%
- *eg: decrease 70 by 32%
- *eg: decrease 5.8 by 13.5%
- *eg: increase/decrease 60 by 40%
- *eg: increase/decrease 70 by 32%
- *eg: increase/decrease 5.8 by 13.5%

Find percentage increase/decrease

- *Find % increase (easy)
- *Find % increase (medium)
- *Find % increase (hard)
- *Find % decrease (easy)
- *Find % decrease (medium)
- *Find % decrease (hard)
- *Find % increase/decrease (easy)
- *Find % increase/decrease (medium)
- *Find % increase/decrease (hard)

Compound interest/depreciation

- *Compound interest: new value
- *Compound interest: interest
- *Compound interest: misc
- *Depreciation: remaining value
- *Depreciation: loss
- *Depreciation: misc
- *Compound interest/depreciation

Reverse percentage problem

- *Reverse % problem - pre-sale

RATIO/PROPORTION

Length, Area, Volume

Metric conversion

- *Convert mm, cm, m, km
- *Convert mm^2 , cm^2 , m^2 , km^2
- *Convert mm^3 , cm^3 , m^3 , km^3
- *Convert metric length/area/volume
- *Convert m/s, km/h
- *Convert ml/litres, cm^3/m^3
- *Convert mg, g, kg, tonnes
- *Convert misc metric units

Ratios

Manipulation of ratios

- *Cancel down a:b
- *Cancel down a:b:c

Using ratios

- *Sharing 2 ways
- *Sharing 3 ways
- *Sharing 2 or 3 ways
- *Increase
- *Decrease
- *Increase/decrease
- *Increase/decrease/share

Percentages

Converting

Similarity

Similar shapes (word problems)

- *Which 2D shapes are always similar?
- *Which 3D shapes are always similar?
- *Which 2D/3D shapes are always similar?
- *Linear scale factor
- *Linear to Area scale factor
- *Linear to Volume scale factor
- *Area to Linear scale factor
- *Volume to Linear scale factor
- *Area to Volume scale factor
- *Volume to Area scale factor
- *Misc. scale factor

Proportion

Finding k

- *Direct proportion
- *Inverse proportion
- *Misc proportion

Finding equation

- *Direct proportion
- *Inverse proportion
- *Misc proportion

Solving

- *Direct proportion
- *Inverse proportion
- *Misc proportion

Pressure, speed, density, acceleration

- *Definition to term [4]
- *Term to definition [4]

Vector, scalar, magnitude, resultant

- *Definition to term [4]
- *Term to definition [4]

Translation, rotation, reflection, enlargement

- *Definition to term [4]
- *Term to definition [4]

Formulae

Pythagoras

- *Definition to term [1]
- *Term to definition [1]

Sin, Cos, Tan ratios

- *Definition to term [3]
- *Term to definition [3]

Sine, Cosine rules and Area of triangle

- *Definition to term [5]
- *Term to definition [5]

Area of trapezium, volume of prism

- *Definition to term [2]
- *Term to definition [2]

Circumference and area of circle

- *Definition to term [2]
- *Term to definition [2]

Angles and Bearings

Measure and draw angles

- *Estimate size (nearest 45°)
- *Estimate size (nearest 15°)
- *Measure size (0-90°)
- *Measure size (90-180°)
- *Measure size (180-360°)
- *Measure size (0-180°)
- *Measure size (0-360°)
- *Draw (0-90°)
- *Draw (90-180°)
- *Draw (180-360°)
- *Draw (0-180°)
- *Draw (0-360°)

Angles on a straight line

- *Find angle (10°) - 1 of 2
- *Find angle (1°) - 1 of 2
- *Find angle (10°) - 1 of 3
- *Find angle (1°) - 1 of 3
- *Find angle (10°) - 1 of 4
- *Find angle (1°) - 1 of 4
- *Find angle (10°) - misc
- *Find angle (1°) - misc
- *Find 2 angles algebraically (1)
- *Find 2 angles algebraically (2)
- *Find 3 angles algebraically (1)
- *Find 3 angles algebraically (2)

Angles at a point

- *Find angle (10°) - 1 of 2
- *Find angle (1°) - 1 of 2
- *Find angle (10°) - 1 of 3
- *Find angle (1°) - 1 of 3
- *Find angle (10°) - 1 of 4

GEOMETRY/MEASURES

Definitions

Acute, right, obtuse, reflex

- *Definition to term [4]
- *Term to definition [4]

Bearing, elevation, depression, perpendicular

- *Definition to term [4]
- *Term to definition [4]

Polygons: 3-6 sides

- *Definition to term [4]
- *Term to definition [4]

Polygons: 7-10 sides

- *Definition to term [4]
- *Term to definition [4]

Polygon, regular, interior, exterior

- *Definition to term [4]
- *Term to definition [4]

Equilateral, isosceles, right-angled, scalene

- *Definition to term [4]
- *Term to definition [4]

Square, rhombus, parallelogram, trapezium, rectangle, kite

- *Definition to term [6]
- *Term to definition [6]

Radius, diameter, circumference, chord

- *Definition to term [4]
- *Term to definition [4]

Arc, sector, tangent, segment

- *Definition to term [4]
- *Term to definition [4]

- *Find angle (1°) - 1 of 4
- *Find angle (10°) - misc
- *Find angle (1°) - misc
- *Find 2 angles algebraically (1)
- *Find 2 angles algebraically (2)
- *Find 3 angles algebraically (1)
- *Find 3 angles algebraically (2)

Bearings

- *Measure
- *Construct
- *Measure off triangle
- *Calculate back-bearings with a diagram
- *Calculate back-bearings with no diagram

Polygons

Triangles

- *Find interior angle (10°)
- *Find interior angle (1°)
- *Find exterior angle (10°)
- *Find exterior angle (1°)
- *Find algebraic interior angle (10°)
- *Find algebraic interior angle (1°)

Quadrilaterals

- *Find interior angle (10°)
- *Find interior angle (1°)
- *Find exterior angle (10°)
- *Find exterior angle (1°)
- *Find algebraic interior angle (10°)
- *Find algebraic interior angle (1°)

Regular Polygons (diagram)

- *Interior angle (5-12)
- *Exterior angle (5-12)
- *Interior angle sum (5-12)
- *Exterior angle sum (5-12)
- *Misc angle (5-12)
- *Misc angle sum (5-12)
- *Misc angle or sum (5-12)

Regular Polygons (text)

- *Interior angle (5-12)
- *Exterior angle (5-12)
- *Interior angle sum (5-12)
- *Exterior angle sum (5-12)
- *Misc angle (5-12)
- *Misc angle sum (5-12)
- *Misc angle or sum (5-12)
- *Interior angle (15-72)
- *Exterior angle (15-72)
- *Interior angle sum (15-72)
- *Exterior angle sum (15-72)
- *Misc angle (15-72)
- *Misc angle sum (15-72)
- *Misc angle or sum (15-72)

Construction & Loci

Basic construction

- *Perpendicular bisector (small)
- *Perpendicular bisector (big)
- *Angle bisector (small)
- *Angle bisector (big)
- *Perpendicular/angle bisector (small)

- *Perpendicular/angle bisector (big)

Other constructions

- *Perpendicular to line at point P (small)
- *Perpendicular to line at point P (big)
- *Perpendicular from point P to line (small)
- *Perpendicular from point P to line (big)
- *Equilateral triangle from baseline (small) [1]
- *Equilateral triangle from baseline (big) [1]
- *Square from baseline (small) [1]
- *Square from baseline (big) [1]
- *Regular hexagon from baseline (small) [1]
- *Regular hexagon from baseline (big) [1]
- *Misc regular polygon from baseline (small) [3]
- *Misc regular polygon from baseline (big) [3]

Constructing triangles

- *ASA triangle (small)
- *ASA triangle (big)
- *SAS triangle (small)
- *SAS triangle (big)
- *SSS triangle (small)
- *SSS triangle (big)

Loci

- *Equidistant from two points (small)
- *Equidistant from two points (big)
- *Equidistant from two lines (small)
- *Equidistant from two lines (big)

Circle Properties

Circle Theorems

- *Isosceles triangles
- *Angles in same segment
- *Angle at centre
- *Angle in a semicircle
- *Alternate segment theorem
- *Tangent - radius
- *Cyclic quadrilaterals
- *Misc. 1-4
- *Misc. 5-7
- *Misc. 1-7

Trigonometry and Pythagoras

Pythagoras

- *Integer sides - find hypotenuse
- *Integer sides - find shorter side
- *Integer sides - find any side
- *Non-integer sides - find hypotenuse
- *Non-integer sides - find shorter side
- *Non-integer sides - find any side

Trigonometry - basics

- *Names of triangle sides
- *Sin ratio from triangle
- *Cos ratio from triangle
- *Tan ratio from triangle
- *Sin/cos/tan ratios from triangle

Trigonometry - calculator usage

- *Evaluate Sin x
- *Evaluate Cos x
- *Evaluate Tan x
- *Evaluate Sin/Cos/Tan x
- *Evaluate $\text{Sin}^{-1} x$

- *Evaluate $\cos^{-1} x$
- *Evaluate $\tan^{-1} x$
- *Evaluate $\sin/\cos/\tan^{-1} x$

Trigonometry - exact values

- * $\sin 0, 30, 45, 60, 90^\circ$ [5]
- * $\cos 0, 30, 45, 60, 90^\circ$ [5]
- * $\tan 0, 30, 45, 60, 90^\circ$ [5]
- * $\sin/\cos/\tan 0, 30, 45, 60, 90^\circ$
- * $\sin 120-360^\circ$ [12]
- * $\cos 120-360^\circ$ [12]
- * $\tan 120-360^\circ$ [12]
- * $\sin/\cos/\tan 120-360^\circ$

Trigonometry - right-angled triangles

- *Sin - find Opposite
- *Sin - find Hypotenuse
- *Sin - find Angle
- *Sin - find Misc
- *Cos - find Adjacent
- *Cos - find Hypotenuse
- *Cos - find Angle
- *Cos - find Misc
- *Tan - find Opposite
- *Tan - find Adjacent
- *Tan - find Angle
- *Tan - find Misc
- *Sin/cos/tan - find Numerator Side
- *Sin/cos/tan - find Denominator Side
- *Sin/cos/tan - find Side
- *Sin/cos/tan - find Angle
- *Sin/cos/tan - find Misc

Trigonometry - non-right-angled triangles

- *Sine Rule - find Side
- *Sine Rule - find Angle
- *Sine Rule - find Misc
- *Cosine Rule - find Side
- *Cosine Rule - find Angle
- *Cosine Rule - find Misc
- *Sine/Cosine Rule - find Side
- *Sine/Cosine Rule - find Angle
- *Sine/Cosine Rule - find Misc
- *Find area of triangle

Trigonometry - mixed questions

- *Find misc side or angle (right-angled triangle)
- *Find misc side or angle (any triangle)

Length, Area, Volume

Metric conversion

- *Convert mm, cm, m, km
- *Convert $\text{mm}^2, \text{cm}^2, \text{m}^2, \text{km}^2$
- *Convert $\text{mm}^3, \text{cm}^3, \text{m}^3, \text{km}^3$
- *Convert metric length/area/volume
- *Convert m/s, km/h
- *Convert ml/litres, cm^3/m^3
- *Convert mg, g, kg, tonnes
- *Convert misc metric units

Metric/imperial conversion

- *Convert inches, mm/cm/m
- *Convert feet, mm/cm/m
- *Convert miles, m/km

- *Convert UK pints, litres
- *Convert UK gallons, litres
- *Convert UK lb, g/kg
- *Convert misc metric/imperial

2D Perimeter, Area (no circles)

- *Perimeter of triangle
- *Area of triangle
- *Perimeter of rectangle
- *Area of rectangle
- *Area of parallelogram
- *Area of trapezium
- *Perimeter of compound shape (no circles)
- *Area of compound shape (no circles)

2D Perimeter, Area (with circles)

- *Circumference of circle
- *Area of circle
- *Perimeter of $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}$ circle
- *Area of $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}$ circle

3D Surface Area, Volume - Cuboid, Cube

- *Cuboid: Surface area
- *Cuboid: Volume
- *Cube: Surface area
- *Cube: Volume
- *Cube: Side from surface area
- *Cube: Side from volume

3D Surface Area, Volume - Cylinder

- *Cylinder: Curved surface area from radius,height
- *Cylinder: Total surface area from radius,height
- *Cylinder: Misc surface area from radius,height
- *Cylinder: Volume from radius,height
- *Cylinder: Misc Area/Volume from radius,height
- *Cylinder: Curved surface area from diameter,height
- *Cylinder: Total surface area from diameter,height
- *Cylinder: Misc surface area from diameter,height
- *Cylinder: Volume from diameter,height
- *Cylinder: Misc Area/Volume from diameter,height
- *Cylinder: Misc surface area from

radius/diameter,height

- *Cylinder: Volume from radius/diameter,height
- *Cylinder: Misc Area/Volume from

radius/diameter,height

3D Surface Area, Volume - Sphere

- *Sphere: Surface area from radius
- *Sphere: Volume from radius
- *Sphere: Misc Area/Volume from radius
- *Sphere: Surface area from diameter
- *Sphere: Volume from diameter
- *Sphere: Misc Area/Volume from diameter
- *Sphere: Surface area from radius/diameter
- *Sphere: Volume from radius/diameter
- *Sphere: Misc Area/Volume from radius/diameter
- *Sphere: Radius from surface area
- *Sphere: Radius from volume
- *Sphere: Diameter from surface area
- *Sphere: Diameter from volume
- *Sphere: Misc Radius/Diameter from surface area/volume
- *Sphere: Surface area from volume

- *Sphere: Volume from surface area
- *Sphere: Misc Volume/Area conversion

3D Surface Area, Volume - Cone

- *Cone: Curved surface area from radius, slant height
- *Cone: Total surface area from radius, slant height
- *Cone: Misc surface area from radius, slant height
- *Cone: Volume from radius, vertical height
- *Cone: Misc Area/Volume from radius, height
- *Cone: Curved surface area from diameter, slant height
- *Cone: Total surface area from diameter, slant height
- *Cone: Misc surface area from diameter, slant height
- *Cone: Volume from diameter, vertical height
- *Cone: Misc Area/Volume from diameter, height
- *Cone: Misc surface area from radius/diameter, slant height

height

- *Cone: Volume from radius/diameter, vertical height
- *Cone: Misc Area/Volume from

radius/diameter, height

3D Surface Area, Volume - Misc shapes

- *Cylinder/Sphere/Cone: Curved surface area from radius, height
- *Cylinder/Sphere/Cone: Total surface area from radius, height
- *Cylinder/Sphere/Cone: Misc surface area from radius, height
- *Cylinder/Sphere/Cone: Volume from radius, height
- *Cylinder/Sphere/Cone: Misc Area/Volume from radius, height
- *Cylinder/Sphere/Cone: Curved surface area from diameter, height
- *Cylinder/Sphere/Cone: Total surface area from diameter, height
- *Cylinder/Sphere/Cone: Misc surface area from diameter, height
- *Cylinder/Sphere/Cone: Volume from diameter, height
- *Cylinder/Sphere/Cone: Misc Area/Volume from diameter, height
- *Cylinder/Sphere/Cone: Misc surface area from radius/diameter, height
- *Cylinder/Sphere/Cone: Volume from radius/diameter, height
- *Cylinder/Sphere/Cone: Misc Area/Volume from radius/diameter, height

3D Surface Area, Volume - Compound solids

- *Hemisphere: Curved surface area from radius
- *Hemisphere: Total surface area from radius
- *Hemisphere: Volume from radius
- *Hemisphere on cylinder: Curved surface area from radius, height
- *Hemisphere on cylinder: Total surface area from radius, height
- *Hemisphere on cylinder: Volume from radius, height
- *Cone on cylinder: Curved surface area from radius, heights
- *Cone on cylinder: Total surface area from radius, heights
- *Cone on cylinder: Volume from radius, heights

- *Misc compound solid: Curved surface area from radius, height
- *Misc compound solid: Total surface area from radius, height
- *Misc compound solid: Volume from radius, height

Similarity

Are triangles similar?

- *AAA with right angle
- *AAA with no right angle
- *SAS
- *SAS vertically opposite
- *SSS
- *AAA/SAS/SSS

Distinct similar triangles

- *Find linear scale factor
- *Find a length
- *Find two lengths

Similar shapes (word problems)

- *Which 2D shapes are always similar?
- *Which 3D shapes are always similar?
- *Which 2D/3D shapes are always similar?
- *Linear scale factor
- *Linear to Area scale factor
- *Linear to Volume scale factor
- *Area to Linear scale factor
- *Volume to Linear scale factor
- *Area to Volume scale factor
- *Volume to Area scale factor
- *Misc. scale factor

Vectors

Column vectors

- *Addition
- *Subtraction
- *Scalar multiplication
- *Misc
- *Co-ordinates to vectors
- *Parallel vectors
- *Magnitude

Transformations

Rotation

- *Rotate by 180
- *Rotate by 90
- *Rotate by 90 or 180
- *Find centre of rotation (180)
- *Find centre of rotation (90)
- *Find centre of rotation (90 or 180)

Reflection

- *Reflect in $x=0$ or $y=0$
- *Reflect in $y=\pm x$
- *Reflect in misc. line
- *Find mirror line ($x=0$ or $y=0$)
- *Find mirror line ($y=\pm x$)
- *Find mirror line (misc)

Translation

- *Translate by column vector (+ve quadrant)
- *Find translation column vector (+ve quadrant)

Enlargement

- *Enlarge by +ve scale factor

- *Find enlargement (+ve scale factor)
- Misc. transformations
- *Identify (easy)
 - *Plot (easy)

STATISTICS

Definitions

Cumulative freq, LQ, UQ, IQR

- *Definition to term [4]
- *Term to definition [4]

Histogram, freq density, class width, grouped freq table

- *Definition to term [4]
- *Term to definition [4]

Mean, median, mode, range

- *Definition to term [4]
- *Term to definition [4]

Presenting Data

Scatter diagrams

- *Describe the correlation
- *Plot a best fit line
- *Plot a best fit line and read off

Pie charts

- *Construct from angles (no protractor)
- *Construct from angles with gap (no protractor)
- *Read off angles (no protractor)
- *Construct from data (no protractor)
- *Construct from data with gap (no protractor)
- *Read off data given total (no protractor)
- *Read off data given one value (no protractor)
- *Construct from data (with protractor)
- *Construct from data with gap (with protractor)
- *Read off data given total (with protractor)
- *Read off data given one value (with protractor)

Cumulative frequency

- *Fill a table
- *Plot graph from given values
- *Fill a table and plot a graph
- *Read off median
- *Read off lower quartile
- *Read off upper quartile
- *Read off lower or upper quartile
- *Read off interquartile range
- *Read off median or quartiles or IQR
- *Read off median and IQR

Histograms

- *Calculate frequency density
- *Calculate frequency
- *Calculate frequency OR density
- *Plot histogram from frequency data
- *Find frequency data from histogram
- *Complete frequency data and histogram

Statistical Measures

Find average and spread from list

- *Mean (from sorted list)
- *Median (from sorted list)
- *Mode (from sorted list)
- *Range (from sorted list)

- *Quartiles (from sorted list)
- *IQR (from sorted list)
- *Mean (from unsorted list)
- *Median (from unsorted list)
- *Mode (from unsorted list)
- *Range (from unsorted list)
- *Quartiles (from unsorted list)
- *IQR (from unsorted list)

Problem-solving average and spread from list

- *Find 2-3 numbers from mean, median, mode, range
- *Find 3-5 numbers from mean, median, mode, range

Find average from table (discrete)

- *Mean (from table)
- *Median (from table)
- *Mode (from table)
- *Range (from table)
- *Mean, median, mode and range (from table)

Find average from table (grouped discrete)

- *Mean (from grouped table)
- *Modal class (from grouped table)
- *Mean, modal class (from table)

Find average from table (grouped continuous)

- *Mean (from grouped table)
- *Modal class (from grouped table)
- *Mean, modal class (from table)

PROBABILITY

Definitions

Probability, outcome, frequency, expected number

- *Definition to term [4]
- *Term to definition [4]

Equally likely outcomes, tree diagram, sample space, conditional prob

- *Definition to term [4]
- *Term to definition [4]

Mutually exclusive, independent, AND rule, OR rule

- *Definition to term [4]
- *Term to definition [4]

Sets: empty, universal, union, intersection, complement, element, subset

- *Definition to term [7]
- *Term to definition [7]

Probability

Probability basics

- *Identify valid probabilities
- *Name probabilities [7]
- *Estimate probabilities of events
- *Describe events with given likelihoods
- *p(A): Pick an object out of a bag
- *p(A): Select a letter from a word
- *p(A): Outcome from die or spinner
- *p(A): Pick a card from a pack
- *p(A): Misc. equally likely outcomes
- *p(A')=1-p(A): Basics
- *p(A'): Pick an object out of a bag
- *p(A'): Select a letter from a word
- *p(A'): Outcome from die or spinner

- * $p(A')$: Pick a card from a pack
- * $p(A')$: Misc. equally likely outcomes
- * $p(A)$ & $p(A')$: Pick an object out of a bag
- * $p(A)$ & $p(A')$: Select a letter from a word
- * $p(A)$ & $p(A')$: Outcome from die or spinner
- * $p(A)$ & $p(A')$: Pick a card from a pack
- * $p(A)$ & $p(A')$: Misc. equally likely outcomes

Probability spinner tables

- *Complete a probability table
- *Probability table NOT RULE
- *Probability table OR RULE
- *Probability table AND RULE
- *Expected frequency from total
- *Total from expected frequency

Probability: mutually exclusive/independent

- *Are events mutually exclusive?
- *Test if mutually exclusive
- *Are events independent?
- *Test if independent

Probability by listing outcomes

- *2 spinners [7]
- *2 dice [7]
- *2 coins [6]
- *3 coins [9]
- *4 coins [12]

Tree diagrams

- *Use a 2x2 tree diagram (repeated)
- *Complete and use a 2x2 tree diagram (repeated)
- *Construct and use a 2x2 tree diagram (repeated)
- *Use a 2x2 tree diagram (independent)
- *Complete and use a 2x2 tree diagram (independent)
- *Construct and use a 2x2 tree diagram (independent)
- *Use a 2x2 tree diagram (conditional)
- *Complete and use a 2x2 tree diagram (conditional)
- *Construct and use a 2x2 tree diagram (conditional)
- *Formulate and solve a quadratic 1 (independent)
- *Formulate and solve a quadratic 2 (independent)
- *Formulate and solve a quadratic 1 (conditional)
- *Formulate and solve a quadratic 2 (conditional)

Sets

Venn diagrams

- *Shade regions (2 sets)
- *Identify regions (2 sets)

Set notation

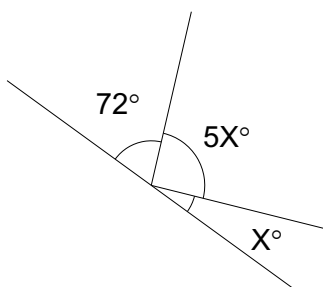
- * $A \cup B$, $A \cap B$, A'
- * $n(A)$, $n(A \cup B)$

Solving equations to find angles

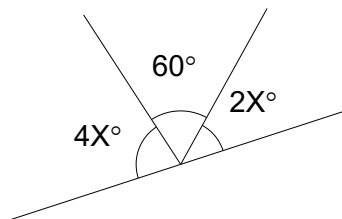
MATHSprint

1: Calculate the unknown angle(s) [diagrams are not accurately drawn]:

a)

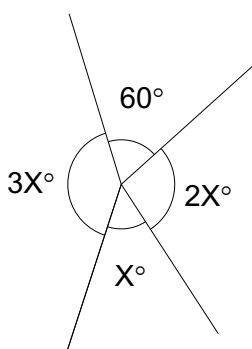


b)

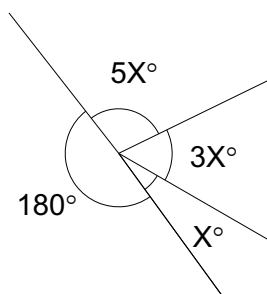


2: Calculate the unknown angle(s) [diagrams are not accurately drawn]:

a)

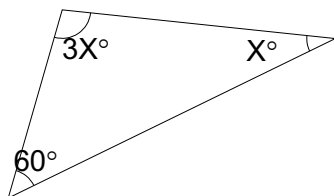


b)

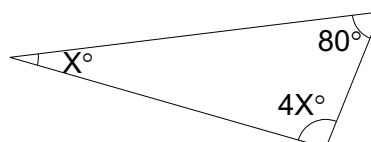


3: Calculate the unknown angle(s) [diagrams are not accurately drawn]:

a)

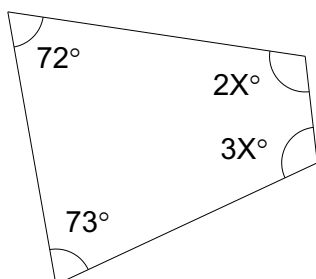


b)

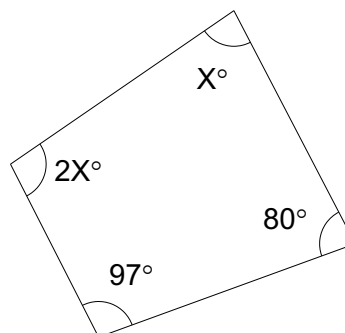


4: Calculate the unknown angle(s) [diagrams are not accurately drawn]:

a)



b)



Answers: Solving equations to find angles

MATHSprint

- 1: a) $6X = 108$ so $X = 18$. Angles are $X^\circ = 18^\circ$, $5X^\circ = 90^\circ$
b) $6X = 120$ so $X = 20$. Angles are $2X^\circ = 40^\circ$, $4X^\circ = 80^\circ$

- 2: a) $6X = 300$ so $X = 50$. Angles are $X^\circ = 50^\circ$, $2X^\circ = 100^\circ$, $3X^\circ = 150^\circ$
b) $9X = 180$ so $X = 20$. Angles are $X^\circ = 20^\circ$, $3X^\circ = 60^\circ$, $5X^\circ = 100^\circ$

- 3: a) 30° , 90° b) 20° , 80°

- 4: a) 86° , 129° b) 61° , 122°

Name:

Class/Set:

BIDMAS Practice

MATHSprint

No calculators!

1: Work out the following:

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

b) $(-7) - (-9) + 4$

c) $9 - 1 - (-2) + 4$

d) $(-4) - 10 - (-9) - (-3)$

e) $10 - (-4) + 5 - (-9)$

f) $(-2) + (-10) - (-7) + 8$

2: Work out the following:

a) $(-1)^2$

b) $(-12) \div 4 \times (-2)$

c) $(-3) \times (-3)^2$

d) $(-4) \times (-2) \div 1$

e) $2 \times (-5)$

f) $(-1)^2 \times 2$

3: Work out the following:

a) $(-7) + 7 \times 2$

b) $2 \times (-6) + (-1) \times (-6)$

c) $6 - 4 \times (-7) + 10$

d) $(-10) + (-3) \times 9 + (-5)$

e) $4 \div (-1) + (-20) \div 4$

f) $(-2) - 8 \times (-10)$

4: Work out the following:

a) $[(-1) + (-1)]^2 - 6 \times (-1)$

b) $[9 + (-4)] \times [(-5) - (-2)]$

c) $[(-6) - 4]^2$

d) $\frac{1 + (-29)}{(-12) - (-5)}$

e) $(-3) \times [(-15) - (-6)]$

f) $\frac{-30}{1 - (-4)}$

Answers: BIDMAS Practice

MATHSprint

1: a) -4 b) 6 c) 14 d) -2 e) 28 f) 3

2: a) 1 b) $(-3) \times (-2) = 6$ c) $(-3) \times 9 = -27$
d) $8 \div 1 = 8$ e) -10 f) $1 \times 2 = 2$

3: a) $(-7) + 14 = 7$ b) $(-12) + 6 = -6$
c) $6 - (-28) + 10 = 44$ d) $(-10) + (-27) + (-5) = -42$
e) $(-4) + (-5) = -9$ f) $(-2) - (-80) = 78$

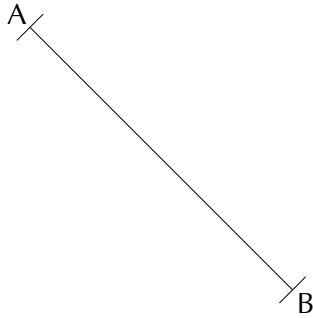
4: a) $4 - (-6) = 10$ b) $5 \times (-3) = -15$ c) $(-10)^2 = 100$
d) $(-28) \div (-7) = 4$ e) $(-3) \times (-9) = 27$ f) $(-30) \div 5 = -6$

Construction

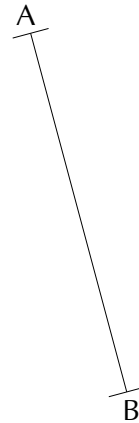
MATHSprint

1: Construct with compasses and straight-edge, showing all your construction lines:

a) Perpendicular bisector of line AB.

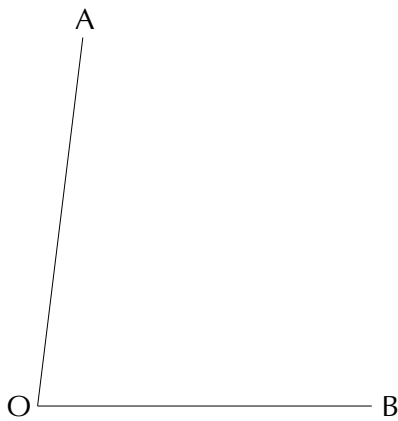


b) Perpendicular bisector of line AB.

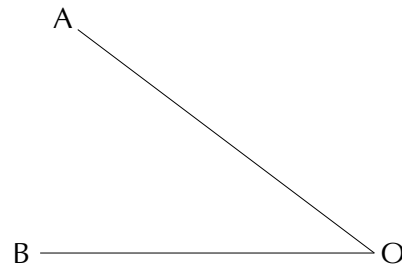


2: Construct with compasses and straight-edge, showing all your construction lines:

a) Bisect angle AOB.



b) Bisect angle AOB.



3: Construct with compasses and straight-edge, showing all your construction lines:

a) A square with base AB.



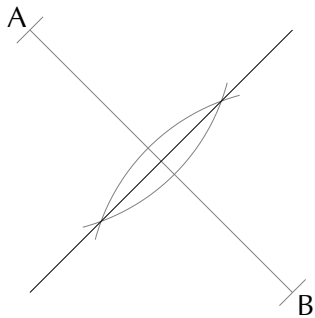
b) An equilateral triangle with base AB.



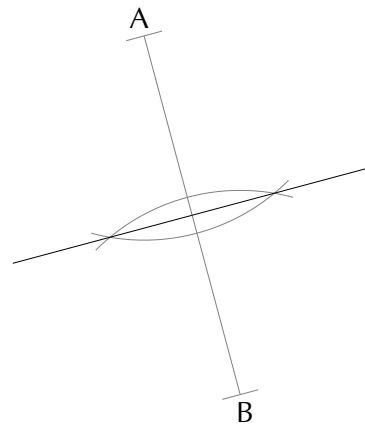
Answers: Construction

MATHSprint

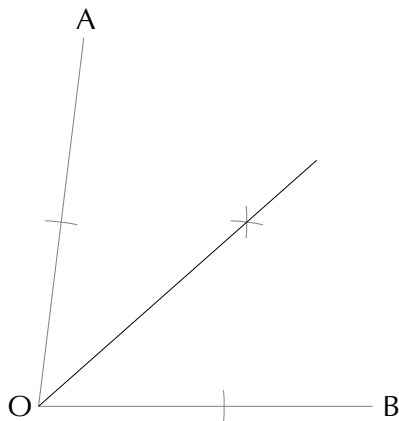
1: a) Perpendicular bisector:



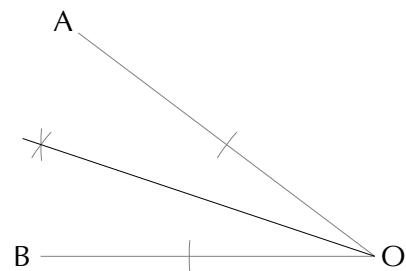
b) Perpendicular bisector:



2: a) Angle bisector:

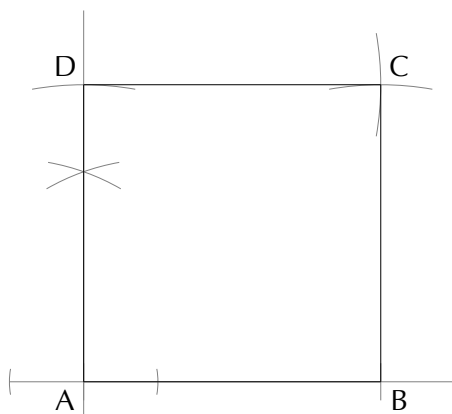


b) Angle bisector:



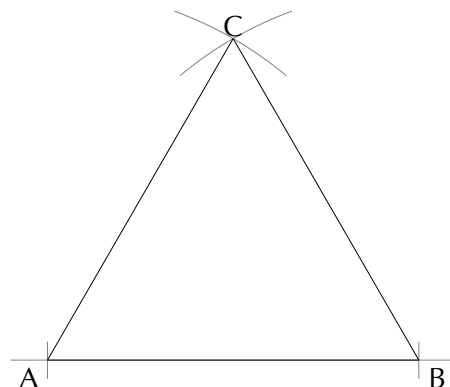
3: a) Square:

Construct perpendicular at A,
mark off base length to get D,
intersect arcs from B & D.



b) Equilateral triangle:

Set compasses to the base length
and intersect arcs from A & B to find C.



Name:

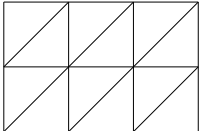
Class/Set:

All about decimals

MATHSprint

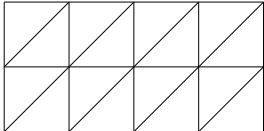
1: Work out the following:

a)

$$\begin{array}{r} 8 \cdot 9 \quad 2 \quad \times \\ \hline \end{array}$$


$$\begin{array}{r} 1 \\ \cdot \\ 8 \end{array}$$

b)

$$\begin{array}{r} 1 \quad 5 \quad 3 \cdot 4 \quad \times \\ \hline \end{array}$$


$$\begin{array}{r} 6 \\ \cdot \\ 2 \end{array}$$

$8.92 \times 1.8 = \underline{\hspace{2cm}}$

$153.4 \times 6.2 = \underline{\hspace{2cm}}$

2: Sort these decimals into **ascending** order, starting with the **smallest** one:

a) 0.66, 0.11, 0.0601, 0.6, 0.601

_____, _____, _____, _____, _____

b) 0.93, 0.309, 0.03, 0.09, 0.909

_____, _____, _____, _____, _____

3: Sort these decimals into **ascending** order, starting with the **smallest** one:

a) 0.0805, 0.8502, 0.8202, 0.8058, 0.0802, 0.828

_____, _____, _____, _____, _____, _____

b) 0.7034, 0.743, 0.7074, 0.7304, 0.073, 0.7307

_____, _____, _____, _____, _____, _____

4: Convert:

a) 0.26 to a percentage _____

b) 0.79 to a percentage _____

5: Convert:

a) 0.009 to a percentage _____

b) 0.0022 to a percentage _____

6: Round to the required accuracy:

a) 0.8231689 to 5 d.p. = _____

b) 9.5168984 to 4 d.p. = _____

7: Work out the following (write down all the figures on your calculator):

a) $\frac{6.2 + (-4.7)}{(-5.1) + (-1.3)} = \underline{\hspace{2cm}}$

b) $\frac{2.8 \times 9.5}{(-7.3) + (-8.1)} = \underline{\hspace{2cm}}$

Answers: All about decimals

MATHSprint

1: a)

$$\begin{array}{r} 8 \cdot 9 \quad 2 \quad \times \\ 1 \quad \begin{array}{|c|c|c|} \hline 0 & 0 & 0 \\ \hline 8 & 9 & 2 \\ \hline 6 & 7 & 1 \\ \hline 4 & 2 & 6 \\ \hline \end{array} \quad 1 \\ 6 \quad \cdot \quad 0 \quad 5 \quad 6 \end{array}$$

16.056

b)

$$\begin{array}{r} 1 \quad 5 \quad 3 \cdot 4 \quad \times \\ 0 \quad \begin{array}{|c|c|c|c|} \hline 0 & 3 & 1 & 2 \\ \hline 6 & 0 & 8 & 4 \\ \hline 0 & 1 & 0 & 0 \\ \hline 2 & 0 & 6 & 8 \\ \hline \end{array} \quad 6 \\ 9 \quad \cdot \quad 5 \quad 1 \quad 0 \quad 8 \end{array}$$

951.08

2: a) 0.0601, 0.11, 0.6, 0.601, 0.66

b) 0.03, 0.09, 0.309, 0.909, 0.93

3: a) 0.0802, 0.0805, 0.8058, 0.8202, 0.828, 0.8502

b) 0.073, 0.7034, 0.7074, 0.7304, 0.7307, 0.743

4: a) 26%

b) 79%

5: a) 0.9%

b) 0.22%

6: a) 0.82317

b) 9.5169

7: a) $\frac{1.5}{-6.4} = -0.2343750000$

b) $\frac{26.60}{-15.4} = -1.727272727$

Name:

Class/Set:

Expanding over one bracket

MATHSprint

1: Multiply out and simplify the following:

a) $3(2a + 7)$

b) $8(10y + 7)$

2: Multiply out and simplify the following:

a) $4(z - 8) + 7(9z - 5)$

b) $2(10f + 9) + 10(4f + 5)$

3: Multiply out and simplify the following:

a) $5(4e - 7) - 6(7e - 3)$

b) $6(5c - 7) - 3(3c + 10)$

4: Multiply out and simplify the following:

a) $9pv(9p + 2v)$

b) $4g(3g - j)$

5: Multiply out and simplify the following:

a) $2b^4(5b^5 - 8b^3 - 2)$

b) $8n^3h^5s^2(7n^3s^3 + h)$

Answers: Expanding over one bracket

MATHSprint

1: a) $6a + 21$

b) $80y + 56$

2: a) $4z - 32 + 63z - 35 = 67z - 67$

b) $20f + 18 + 40f + 50 = 60f + 68$

3: a) $20e - 35 - 42e + 18 = -22e - 17$

b) $30c - 42 - 9c - 30 = 21c - 72$

4: a) $81p^2v + 18pv^2$

b) $12g^2 - 4gj$

5: a) $10b^9 - 16b^7 - 4b^4$

b) $56n^6h^5s^5 + 8n^3h^6s^2$

Fraction revision

MATHSprint

Please answer in your books – remember to show all your working!

1: Work out the following, showing your method and simplifying your answer:

a) Show that $\frac{23}{24} - \frac{5}{8} = \frac{1}{3}$

b) Show that $\frac{7}{10} + \frac{7}{40} = \frac{7}{8}$

2: Work out the following, showing your method and simplifying your answer:

a) Show that $2\frac{17}{30} - 1\frac{1}{6} = 1\frac{2}{5}$

b) Show that $1\frac{1}{12} + 4\frac{2}{3} = 5\frac{3}{4}$

3: Work out the following, showing your method and simplifying your answer:

a) Show that $\frac{5}{6} - \frac{3}{4} = \frac{1}{12}$

b) Show that $\frac{1}{6} + \frac{2}{9} = \frac{7}{18}$

4: Work out the following, showing your method and simplifying your answer:

a) Show that $3\frac{1}{3} - 2\frac{4}{5} = \frac{8}{15}$

b) Show that $4\frac{5}{7} + 1\frac{3}{4} = 6\frac{13}{28}$

5: Work out the following, showing your method and simplifying your answer:

a) Show that $\frac{1}{8} \div \frac{5}{6} = \frac{3}{20}$

b) Show that $\frac{1}{10} \times \frac{2}{9} = \frac{1}{45}$

6: Work out the following, showing your method and simplifying your answer:

a) Show that $2\frac{1}{3} \times \frac{5}{6} = 1\frac{17}{18}$

b) Show that $\frac{7}{9} \div 3\frac{1}{3} = \frac{7}{30}$

7: Work out the following, showing your method and simplifying your answer:

a) Show that $1\frac{2}{3} \times 1\frac{1}{3} = 2\frac{2}{9}$

b) Show that $1\frac{3}{4} \div 2\frac{2}{3} = \frac{21}{32}$

Answers: Fraction revision

MATHSprint

1: a) $\frac{23}{24} - \frac{5}{8} = \frac{1}{3} = \frac{1}{3}$

b) $\frac{7}{10} + \frac{7}{40} = \frac{7}{8} = \frac{7}{8}$

2: a) $2\frac{17}{30} - 1\frac{1}{6} = 1\frac{2}{5} = 1\frac{2}{5}$

b) $1\frac{1}{12} + 4\frac{2}{3} = 5\frac{3}{4} = 5\frac{3}{4}$

3: a) $\frac{5}{6} - \frac{3}{4} = \frac{1}{12}$

b) $\frac{1}{6} + \frac{2}{9} = \frac{7}{18}$

4: a) $3\frac{1}{3} - 2\frac{4}{5} = \frac{8}{15}$

b) $4\frac{5}{7} + 1\frac{3}{4} = 6\frac{13}{28}$

5: a) $\frac{1}{8} \div \frac{5}{6} = \frac{1}{8} \times \frac{6}{5} = \frac{1}{4} \times \frac{3}{5} = \frac{3}{20}$

b) $\frac{1}{10} \times \frac{2}{9} = \frac{1}{5} \times \frac{1}{9} = \frac{1}{45}$

6: a) $\frac{7}{3} \times \frac{5}{6} = \frac{35}{18} = 1\frac{17}{18}$

b) $\frac{7}{9} \div \frac{10}{3} = \frac{7}{9} \times \frac{3}{10} = \frac{7}{3} \times \frac{1}{10} = \frac{7}{30}$

7: a) $\frac{5}{3} \times \frac{4}{3} = \frac{20}{9} = 2\frac{2}{9}$

b) $\frac{7}{4} \div \frac{8}{3} = \frac{7}{4} \times \frac{3}{8} = \frac{21}{32}$

Name:

Class/Set:

Indices practice

MATHSprint

1: Simplify the following:

a) $(z^8)^6 = \underline{\hspace{2cm}}$

b) $y^9 \div y^2 = \underline{\hspace{2cm}}$

c) $\frac{w^{26}}{w^5 \times w^{12}} = \underline{\hspace{2cm}}$

d) $h \times h \times h \times h = \underline{\hspace{2cm}}$

e) $t^4 \times t^7 = \underline{\hspace{2cm}}$

f) $u \times u \times u = \underline{\hspace{2cm}}$

2: Simplify the following:

a) $(r^{-4})^5 = \underline{\hspace{2cm}}$

b) $\frac{1}{p \times p} = \underline{\hspace{2cm}}$

c) $g^{-10} \div g^{-1} = \underline{\hspace{2cm}}$

d) $c^5 \times c^{-3} = \underline{\hspace{2cm}}$

e) $\frac{x \times x^{-4}}{x^{-4}} = \underline{\hspace{2cm}}$

f) $k^{-7} \times k^{10} = \underline{\hspace{2cm}}$

3: Simplify the following:

a) $\frac{2q^5 \times 40q^{10}}{10q^2} = \underline{\hspace{2cm}}$

b) $2f^{10} \times 3f^9 \times 10f^7 = \underline{\hspace{2cm}}$

c) $\frac{(5e)^3}{5e} = \underline{\hspace{2cm}}$

d) $(3a^5)^2 \times 3a = \underline{\hspace{2cm}}$

4: Simplify the following:

a) $(4n^3b)^2 = \underline{\hspace{2cm}}$

b) $\frac{10v^{18}j^{13}}{5v^{8 \cdot 9}} = \underline{\hspace{2cm}}$

c) $4m^6s^4 \times 5m^2s = \underline{\hspace{2cm}}$

d) $\frac{12h^{11}x^{11}}{4h^6x^2} = \underline{\hspace{2cm}}$

5: Simplify the following:

a) $(r^9)^{2/3} = \underline{\hspace{2cm}}$

b) $z^{1/4} \div z^{5/4} = \underline{\hspace{2cm}}$

c) $c^{1/2} \times c^{3/2} = \underline{\hspace{2cm}}$

d) $(a^{12})^{1/2} = \underline{\hspace{2cm}}$

6: Solve the following:

a) $2^x = \frac{1}{8}$

b) $125^x = \frac{1}{5}$

c) $64^x = 4$

d) $2^x = 1$

$x = \underline{\hspace{2cm}}$

$x = \underline{\hspace{2cm}}$

$x = \underline{\hspace{2cm}}$

$x = \underline{\hspace{2cm}}$

Answers: Indices practice

MATHSprint

1: a) z^{48} b) y^7 c) w^9 d) h^4 e) t^{11} f) u^3

2: a) r^{-20} b) p^{-2} c) g^{-9} d) c^2 e) x f) k^3

3: a) $8q^{13}$ b) $60f^{26}$ c) $25e^2$ d) $27a^{11}$

4: a) $16n^6b^2$ b) $2v^{10}j^4$ c) $20m^8s^5$ d) $3h^5x^9$

5: a) r^6 b) z^{-1} c) c^2 d) a^6

6: a) $x = -3$ b) $x = -\frac{1}{3}$ c) $x = \frac{1}{3}$ d) $x = 0$

Name:

Class/Set:

Mean, Median, Mode, Range - problem-solving

MATHSprint

1: Give the word or phrase being defined:

a) The middle data value when all the numbers are listed in order (or the mean of the middle two values).

b) The most common data value.

c) The largest data value minus the smallest data value.

d) The sum of the data values divided by the number of items.

2: Work out the following:

a) Find three numbers with a mode of 37 and a range of 27.

b) Find two numbers with a median of 15 and a range of 2.

c) Find two numbers with a mean of 12 and a range of 20.

3: Work out the following:

a) Find four numbers with a mode of 29, a median of 26 and a range of 10.

b) Find four numbers with a mode of 39, a median of 34 and a mean of 31.

c) Find three numbers with a median of 20, a range of 11 and a mean of 21.

Answers: Mean, Median, Mode, Range - problem-solving

MATHSprint

1:	a) Median	b) Mode	c) Range	d) Mean
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2:	a) 37, 37, 64 or 10, 37, 37	b) 14, 16	c) 2, 22
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3:	a) 19, 23, 29, 29	b) 17, 29, 39, 39	c) 16, 20, 27
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Probability and Tree Diagrams

MATHSprint

1: Two fair spinners are numbered 1 to 7 and 1 to 3.
Their scores are added together. Complete the table and hence find:

	1	2	3	4	5	6	7
1							
2							
3							

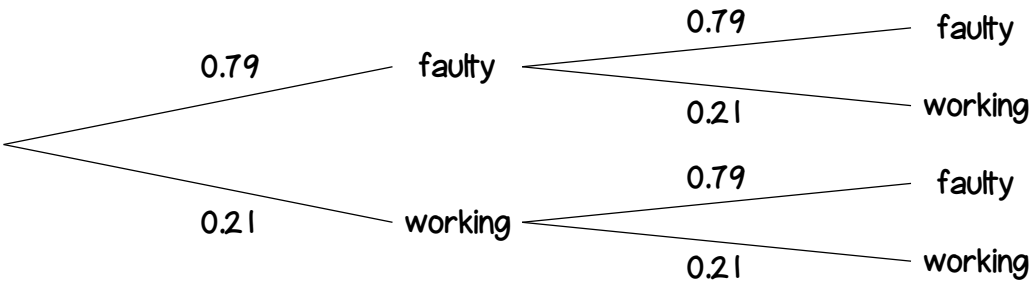
- a) $p(\text{sum is even})$
- b) $p(\text{sum} > 4)$
- c) $p(\text{sum} < 7)$
- d) $p(\text{sum} \geq 8)$
-
-

2: List the possible outcomes when three unbiased coins are flipped, and hence find:

Coin 1	
Coin 2	
Coin 3	

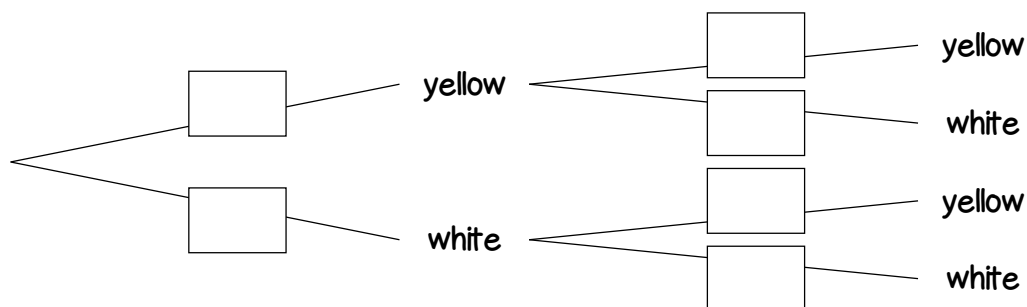
- a) $p(\text{exactly 1 Head})$
- b) $p(\text{at least 1 Tail})$
- c) $p(\text{at least 2 Heads})$
- d) $p(\text{no Tails})$
-
-

3: The probability of a certain type of calculator being faulty is 0.79.
Two calculators are selected at random.
Use this tree diagram to answer the following:



- a) What is the probability of getting two working calculators?
-
- b) What is the probability of getting at least one faulty calculator?
-
- c) What is the probability of getting exactly one faulty calculator?
-

- 4: One spinner has 4 yellow sections and 3 white sections (all equal).
Another spinner has 1 yellow section and 7 white sections (all equal).
Complete this tree diagram and hence answer the following:



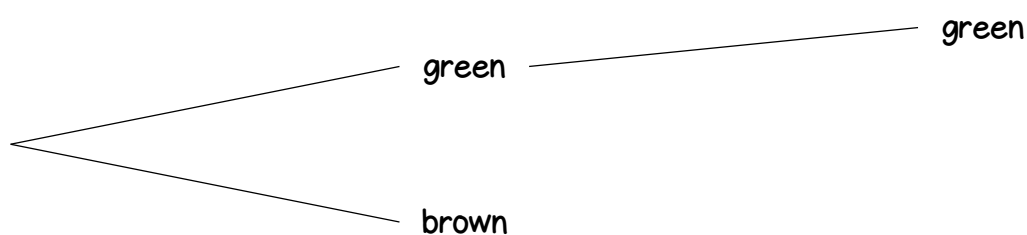
- a) What is the probability of getting white twice?

- b) What is the probability of getting yellow at least once?

- c) What is the probability of getting the same colour twice?

- d) What is the probability of getting different colours?

- 5: A bag contains 2 green sweets and 4 brown sweets.
A sweet is chosen at random and **not replaced** before choosing another one.
Complete this tree diagram and hence answer the following:



- a) What is the probability of getting two green sweets?

- b) What is the probability of not getting two green sweets?

- c) What is the probability of getting two sweets of the same colour?

- d) What is the probability of getting two sweets of different colours?

Answers: Probability and Tree Diagrams

1:

	1	2	3	4	5	6	7
1	2	3	4	5	6	7	8
2	3	4	5	6	7	8	9
3	4	5	6	7	8	9	10

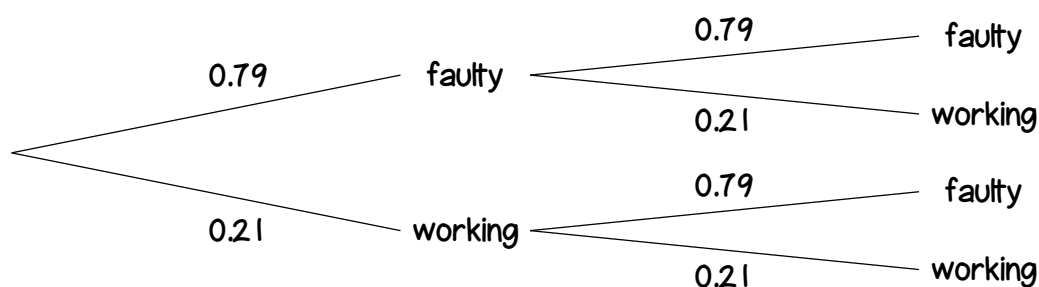
a) $p(\text{sum is even}) = \frac{11}{21}$. b) $p(\text{sum} > 4) = \frac{15}{21} = \frac{5}{7}$. c) $p(\text{sum} < 7) = \frac{12}{21} = \frac{4}{7}$. d) $p(\text{sum} \geq 8) = \frac{6}{21} = \frac{2}{7}$.

2:

1	H	T	H	T	H	T	H	T
2	H	H	T	T	H	H	T	T
3	H	H	H	H	T	T	T	T

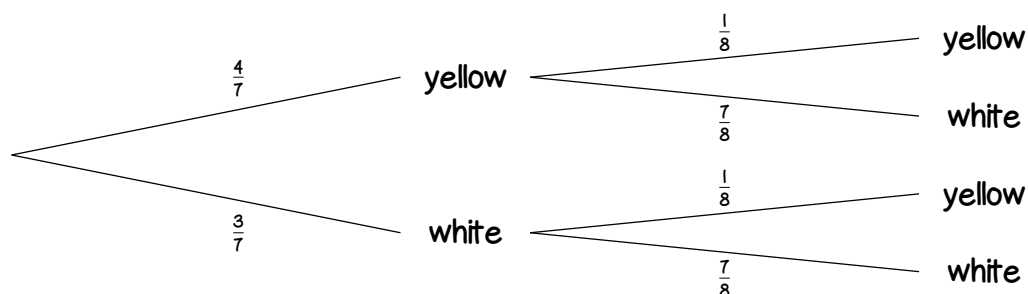
a) $p(\text{exactly 1 Head}) = \frac{3}{8}$ b) $p(\text{at least 1 Tail}) = \frac{7}{8}$
 c) $p(\text{at least 2 Heads}) = \frac{4}{8} = \frac{1}{2}$ d) $p(\text{no Tails}) = \frac{1}{8}$

3:



a) $p(\text{getting two working calculators}) = 0.21 \times 0.21 = 0.0441$
 b) $p(\text{getting at least one faulty calculator}) = 1 - 0.21 \times 0.21 = 0.9559$
 c) $p(\text{getting exactly one faulty calculator}) = 0.79 \times 0.21 + 0.21 \times 0.79 = 0.3318$

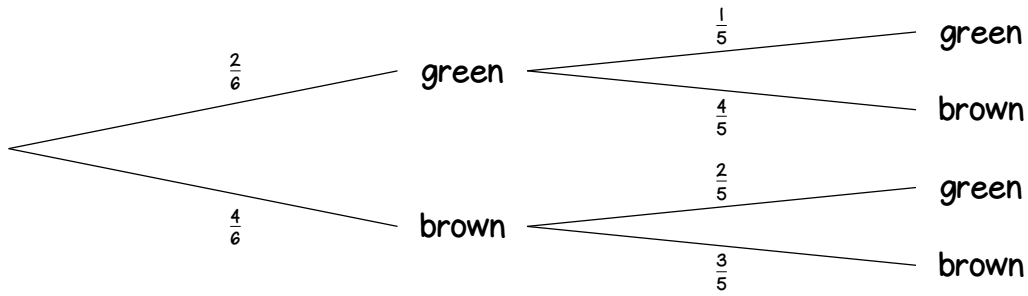
4:



a) $p(\text{getting white twice}) = \frac{3}{7} \times \frac{7}{8} = \frac{21}{56} = \frac{3}{8}$
 b) $p(\text{getting yellow at least once}) = 1 - \frac{3}{7} \times \frac{7}{8} = \frac{35}{56} = \frac{5}{8}$
 c) $p(\text{getting the same colour twice}) = \frac{4}{7} \times \frac{1}{8} + \frac{3}{7} \times \frac{7}{8} = \frac{25}{56}$

$$d) p(\text{getting different colours}) = \frac{4}{7} \times \frac{7}{8} + \frac{3}{7} \times \frac{1}{8} = \frac{31}{56}$$

5:



$$a) p(\text{getting two green sweets}) = \frac{2}{6} \times \frac{1}{5} = \frac{2}{30} = \frac{1}{15}$$

$$b) p(\text{not getting two green sweets}) = 1 - \frac{2}{6} \times \frac{1}{5} = \frac{28}{30} = \frac{14}{15}$$

$$c) p(\text{getting two sweets of the same colour}) = \frac{2}{6} \times \frac{1}{5} + \frac{4}{6} \times \frac{3}{5} = \frac{14}{30} = \frac{7}{15}$$

$$d) p(\text{getting two sweets of different colours}) = \frac{2}{6} \times \frac{4}{5} + \frac{4}{6} \times \frac{2}{5} = \frac{16}{30} = \frac{8}{15}$$

Name:

Class/Set:

Toolkit for Proof Questions

MATHSprint

1: Give an algebraic expression for the following:

a) A multiple of 3

b) A square number

c) A multiple of 10

d) A power of 3

2: Give an algebraic expression or expressions for the following, simplifying where possible:

a) Two different odd numbers.

b) An odd square number.

c) An even square number.

d) Three consecutive numbers.

3: Give an algebraic expression for the following, simplifying where possible:

a) 2 less than a cube number.

b) 1 more than a multiple of 8.

c) 3 less than a multiple of 10.

d) 5 more than a multiple of 6.

4: Give an algebraic expression for the following, simplifying where possible:

a) The sum of three consecutive numbers.

b) The sum of two even numbers.

c) The product of two consecutive odd numbers.

d) The product of two even numbers.

5: Give an algebraic expression for the following, simplifying where possible:

a) The sum of the squares of three consecutive numbers.

b) The difference between the squares of two consecutive odd numbers.

c) The difference between the squares of two consecutive even numbers.

d) The difference between the cubes of two consecutive numbers.

6: How do you prove that an expression always gives:

a) A non-square number?

b) A multiple of n ?

c) A square number?

d) A positive number?

Answers: Toolkit for Proof Questions

MATHSprint

1: a) $3n$ b) n^2 c) $10n$ d) 3^n

2: a) $2m+1, 2n+1$ b) $(2n+1)^2 = 4n^2+4n+1$
 c) $(2n)^2 = 4n^2$ d) $n-1, n, n+1$ OR $n, n+1, n+2$

3: a) n^2-2 . b) $8n+1$. c) $10n-3$. d) $6n+5$.

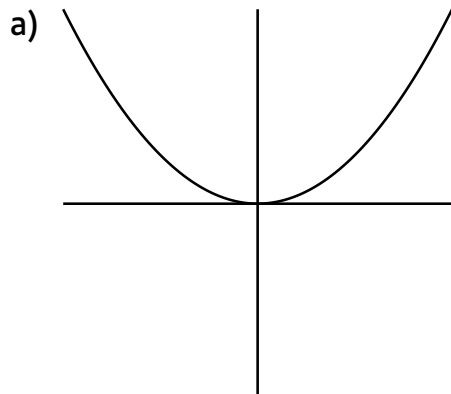
4: a) $n-1 + n + n+1 = 3n$ b) $2m + 2n = 2(m+n)$
 c) $(2n-1) \times (2n+1) = 4n^2-1$ d) $2m \times 2n = 4mn$

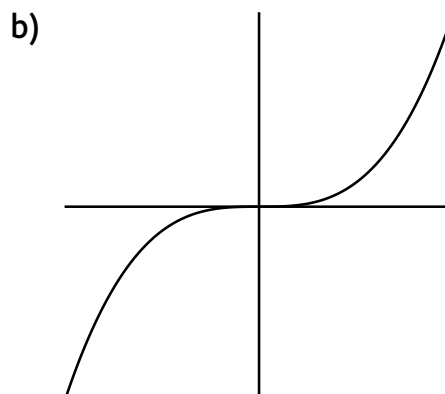
5: a) $(n-1)^2 + n^2 + (n+1)^2 = 3n^2+2$ b) $(2n+1)^2 - (2n-1)^2 = 8n$
 c) $(2n+2)^2 - (2n)^2 = 8n+4$ d) $(n+1)^3 - n^3 = 3n^2+3n+1$

- 6: a) Show that the answer N lies between two consecutive square numbers: $n^2 < N < (n+1)^2$.
 b) Write the answer as n [integer expression].
 c) Write the answer as [integer expression]².
 d) Write the answer as [expression]² + [number > 0] (e.g. complete the square).

Recognising Graphs

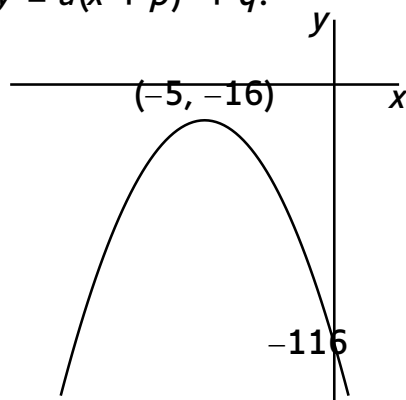
1: Suggest an equation for each graph.



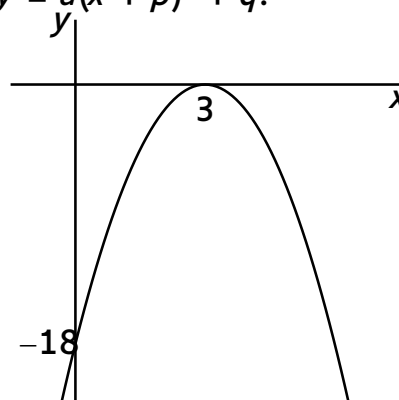


2: Complete the following:

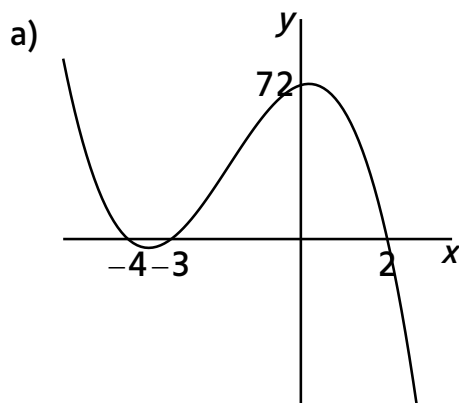
a) Write the equation of this quadratic graph in the form $y = a(x + p)^2 + q$.

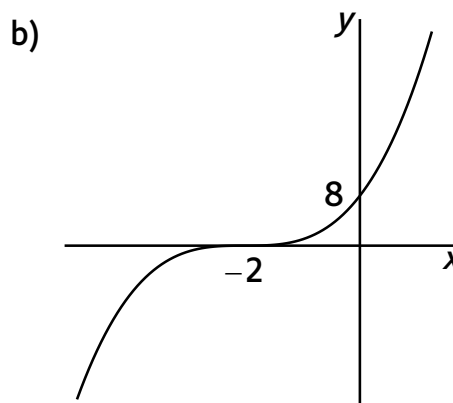


b) Write the equation of this quadratic graph in the form $y = a(x + p)^2 + q$.



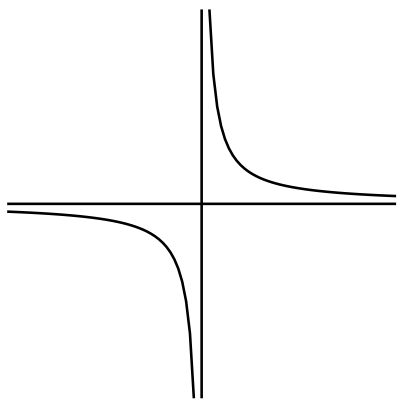
3: Suggest a factorised equation for each graph.:



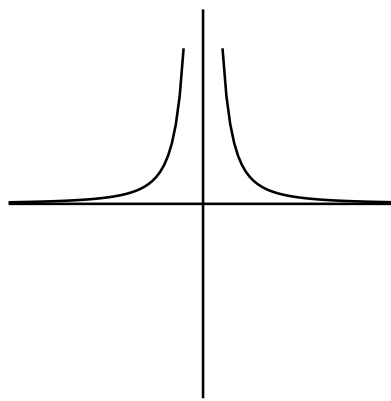


4: Suggest an equation for each graph.

a)

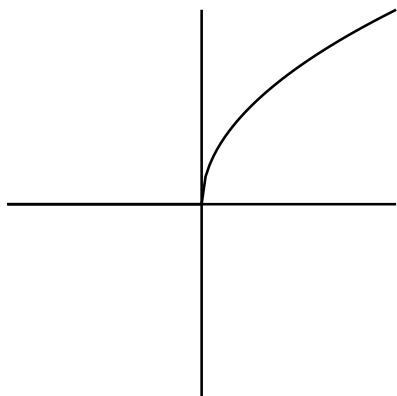


b)

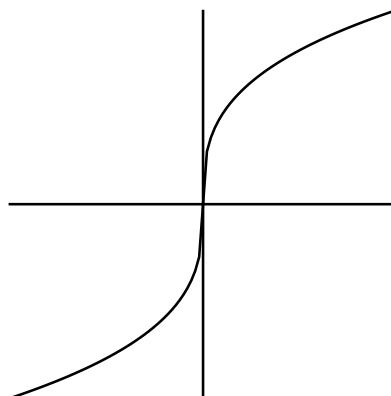


5: Suggest an equation for each graph.

a)

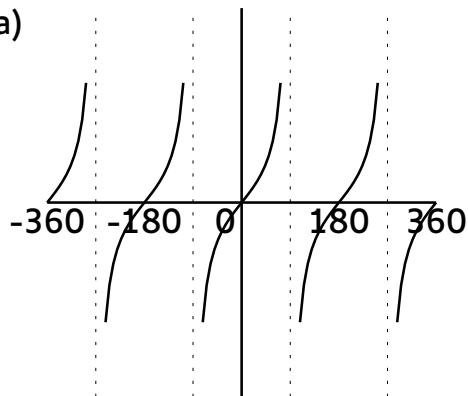


b)

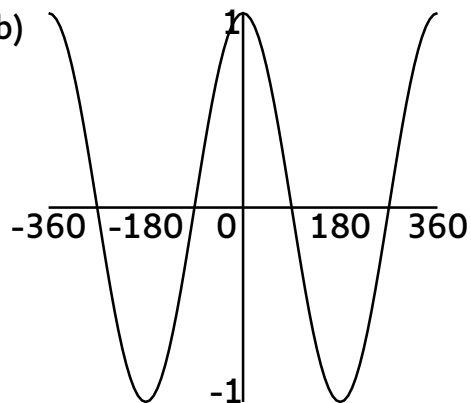


6: Suggest an equation for each graph.

a)



b)



Answers: Recognising Graphs

MATHSprint

1: a) $y = x^2$

b) $y = x^3$

2: a) $y = -4(x + 5)^2 - 16.$

b) $y = -2(x - 3)^2.$

3: a) $y = -3(x + 4)(x - 2)(x + 3)$

b) $y = (x + 2)^3$

4: a) $y = \frac{1}{x}$

b) $y = \frac{1}{x^2}$

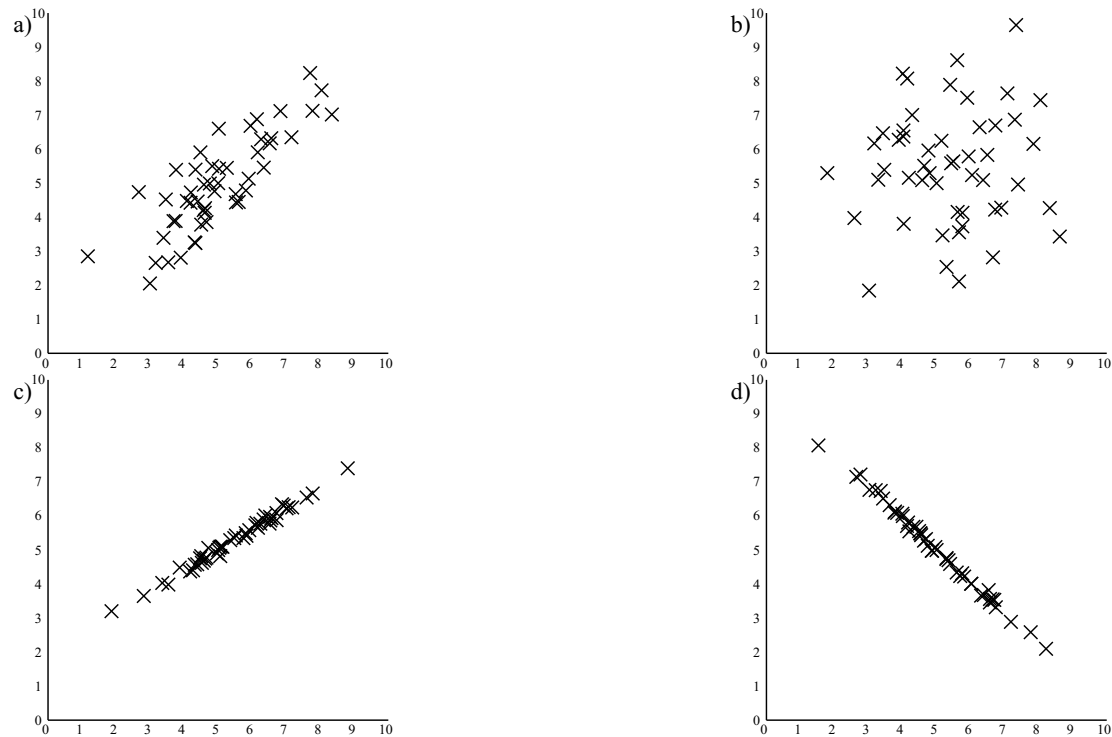
5: a) $y = \sqrt{x}$

b) $y = \sqrt[3]{x}$

6: a) $y = \tan x$

b) $y = \cos x$

1: Describe the correlation shown in the scatter graph:



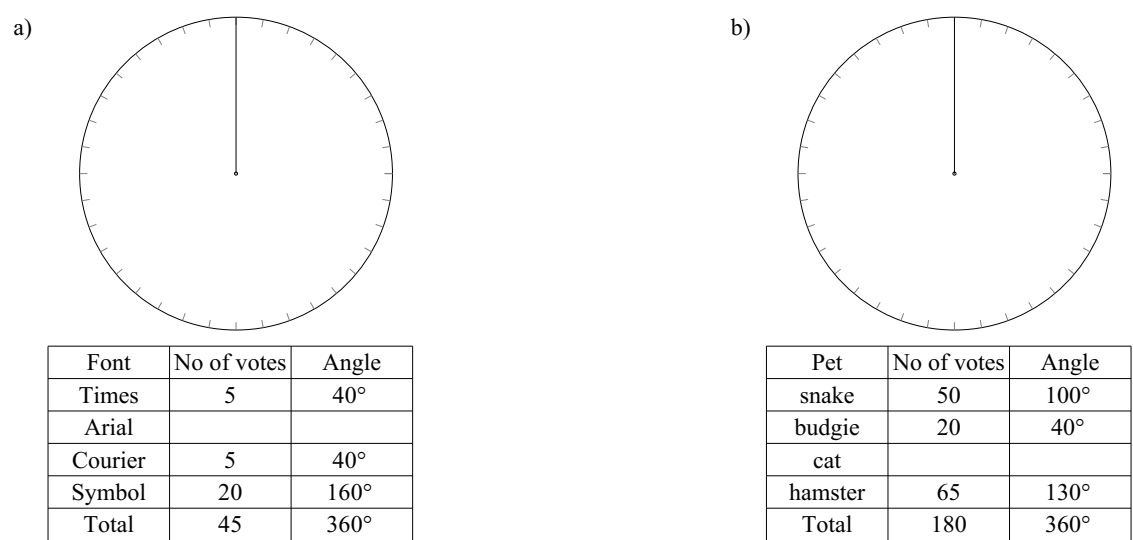
2: Draw a best-fit line and read off values:



Give the value of y when $x = 7$.

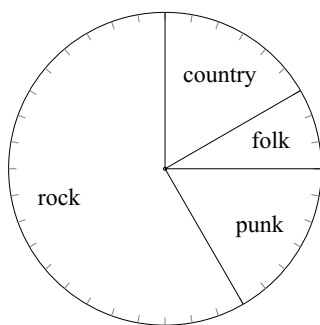
Give the value of y when $x = 5$.

3: Construct a pie chart of people's favourite choices:



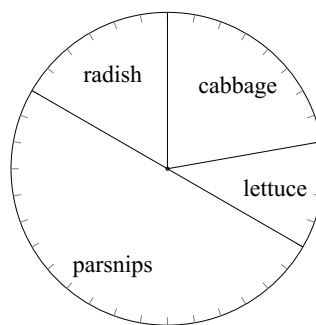
4: Read angles off a pie chart of people's favourite choices:

a)



Music	Angle
country	
folk	
punk	
rock	
Total	

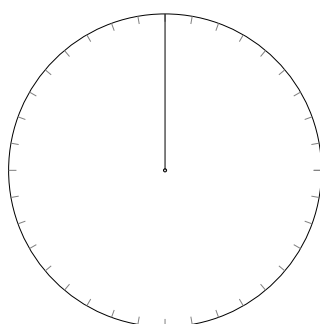
b)



Vegetable	Angle
cabbage	
lettuce	
parsnips	
radish	
Total	

5: Complete the table and construct a pie chart of people's favourite choices:

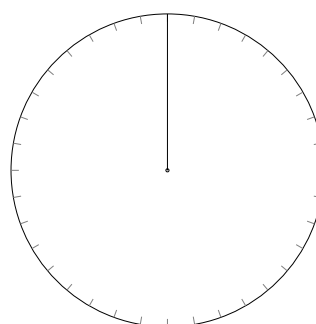
a)



Sport	No of votes	Angle
rugby	16	
netball	14	
cricket	34	
tennis		
Total	72	

1 vote is _____ degrees.

b)

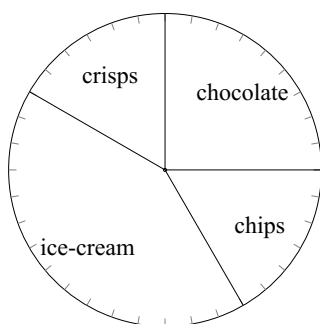


Colour	No of votes	Angle
pink		
red	18	
yellow	6	
orange	10	
Total	36	

1 vote is _____ degrees.

6: Read angles off a pie chart of people's favourite choices and find the missing values:

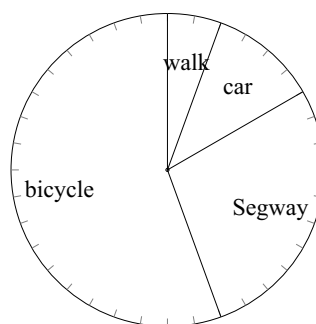
a)



Snack	No of votes	Angle
chocolate		
chips		
ice-cream		
crisps	10	
Total		

1 vote is _____ degrees.

b)

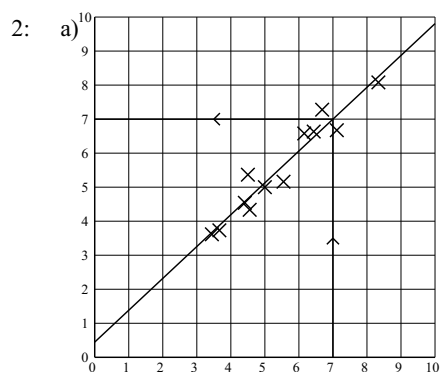


Transport	No of votes	Angle
walk	1	
car		
Segway		
bicycle		
Total		

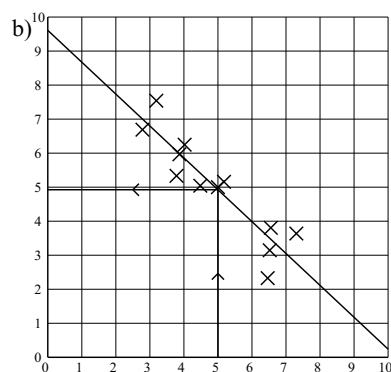
1 vote is _____ degrees.

Answers: Scatter diagrams, pie charts

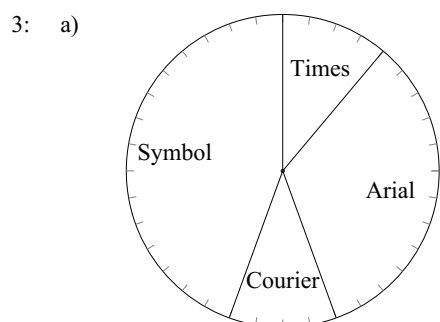
- 1: a) Weak positive correlation b) No correlation c) Strong positive correlation d) Strong negative correlation



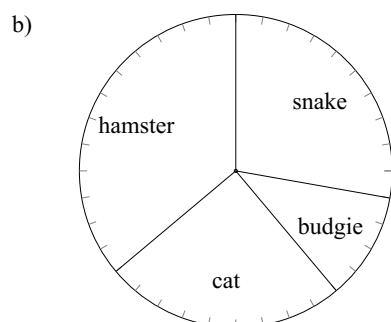
$y = 7.0$ when $x = 7$.



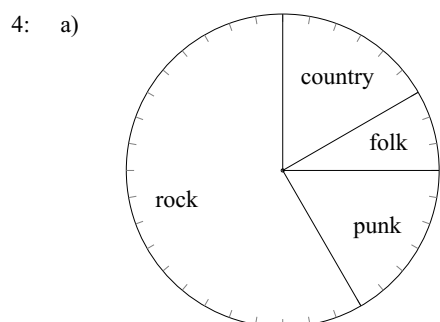
$y = 4.9$ when $x = 5$.



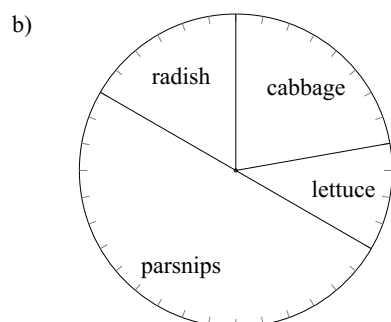
Font	No of votes	Angle
Times	5	40°
Arial	15	120°
Courier	5	40°
Symbol	20	160°
Total	45	360°



Pet	No of votes	Angle
snake	50	100°
budgie	20	40°
cat	45	90°
hamster	65	130°
Total	180	360°

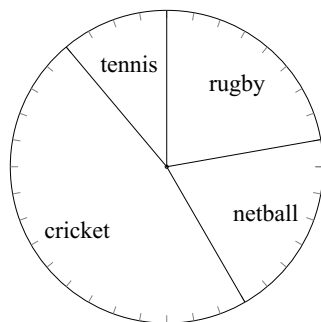


Music	Angle
country	60°
folk	30°
punk	60°
rock	210°
Total	360°



Vegetable	Angle
cabbage	80°
lettuce	40°
parsnips	180°
radish	60°
Total	360°

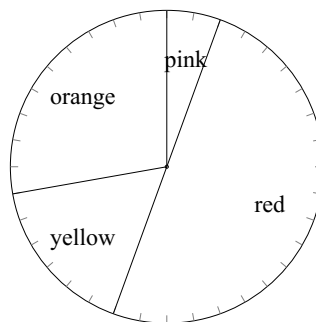
5: a)



Sport	No of votes	Angle
rugby	16	80°
netball	14	70°
cricket	34	170°
tennis	8	40°
Total	72	360°

1 vote is **5** degrees.

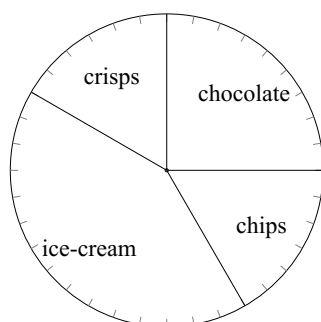
b)



Colour	No of votes	Angle
pink	2	20°
red	18	180°
yellow	6	60°
orange	10	100°
Total	36	360°

1 vote is **10** degrees.

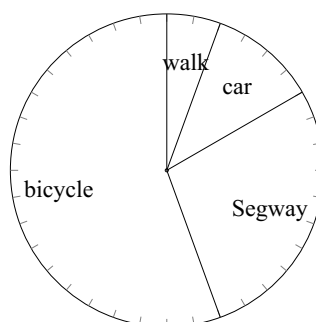
6: a)



Snack	No of votes	Angle
chocolate	15	90°
chips	10	60°
ice-cream	25	150°
crisps	10	60°
Total	60	360°

1 vote is **6** degrees.

b)



Transport	No of votes	Angle
walk	1	20°
car	2	40°
Segway	5	100°
bicycle	10	200°
Total	18	360°

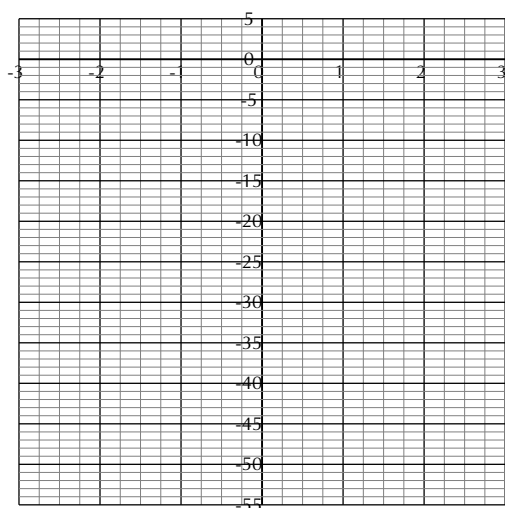
1 vote is **20** degrees.

Plotting and solving using graphs

1: Complete the table of values for each function (to 1 dp if required) and plot the graph:

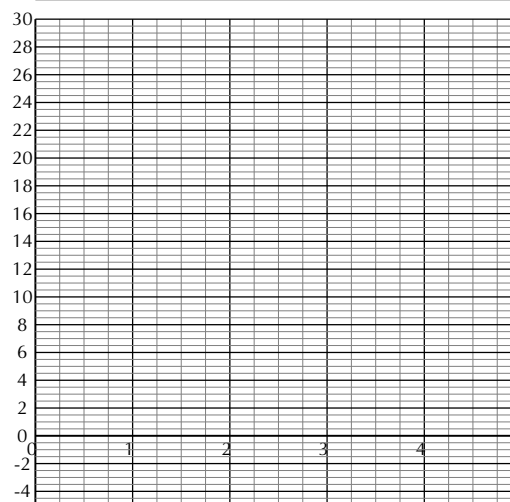
a) $y = x^3 - 2x^2 - 7$

x	-3	-2	-1	0	1	2	3
y						-7	



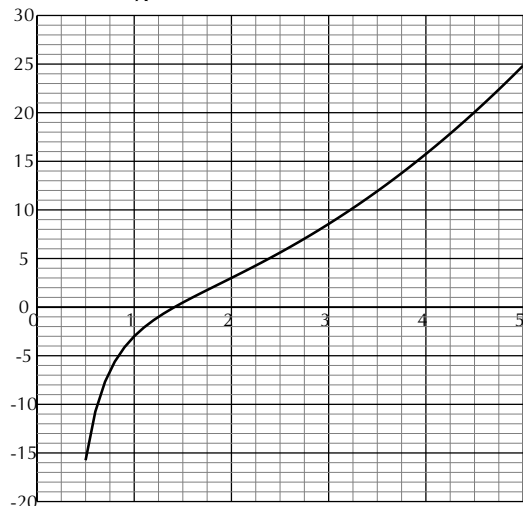
b) $y = x^2 - \frac{1}{x^2}$

x	0.5	1	1.5	2	3	4	5
y			1.8				



2: Use the graph to find approximate solutions to each equation:

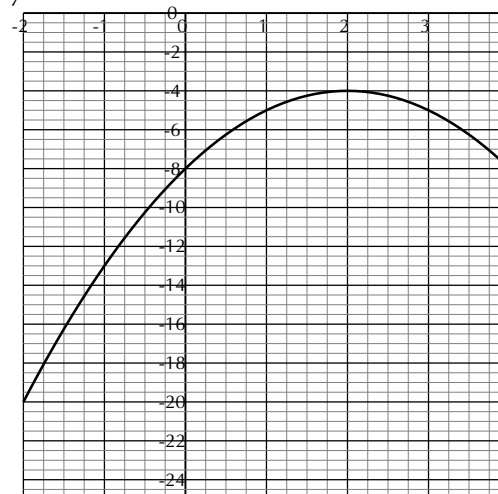
a) $y = x^2 - \frac{4}{x^2}$



Solve $x^2 - \frac{4}{x^2} = 10$.

$x \approx$ _____

b) $y = -x^2 + 4x - 8$

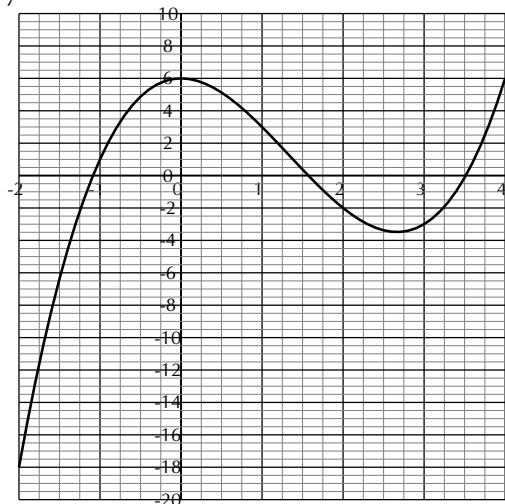


Solve $-x^2 + 4x - 8 = -8$.

$x \approx$ _____

3: Draw a suitable straight line on the graph to find approximate solutions to each equation:

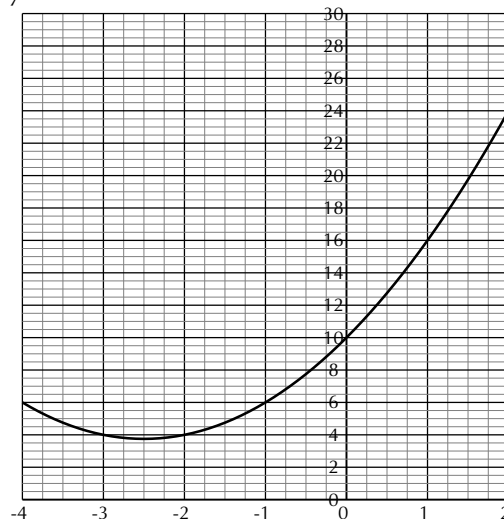
a) $y = x^3 - 4x^2 + 6$



Solve $x^3 - 4x^2 + 2x + 10 = 6$.

$x \approx$ _____

b) $y = x^2 + 5x + 10$

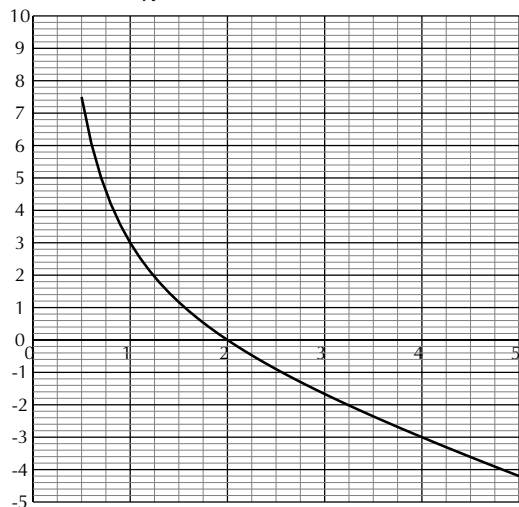


Solve $x^2 + 3x + 12 = -5x + 18$.

$x \approx$ _____

4: Find the gradient of the graph at the given point:

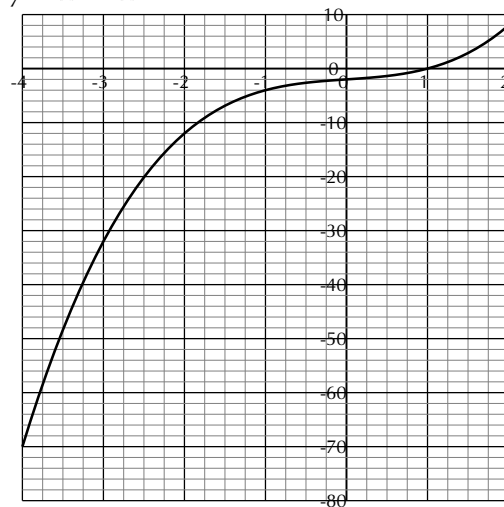
a) $y = -x + \frac{4}{x}$



Find the gradient at $x = 2.5$.

Gradient =

b) $y = x^3 + x - 2$



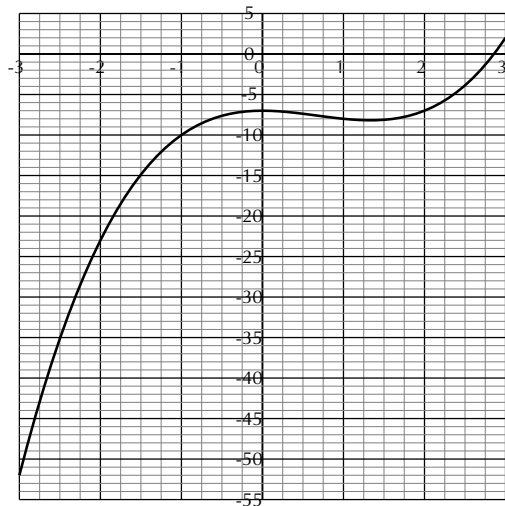
Find the gradient at $x = -3$.

Gradient =

Answers: Plotting and solving using graphs

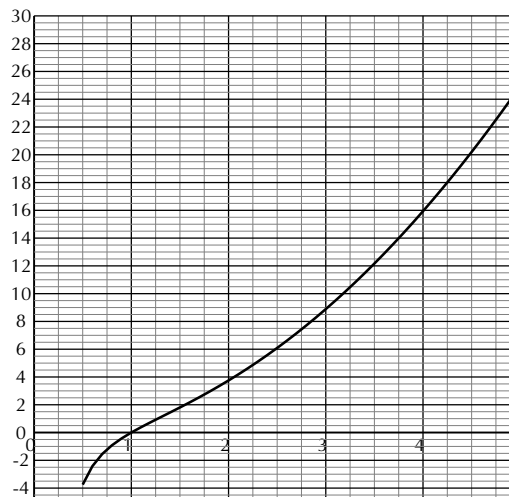
1: a) $y = x^3 - 2x^2 - 7$

x	-3	-2	-1	0	1	2	3
y	-52	-23	-10	-7	-8	-7	2

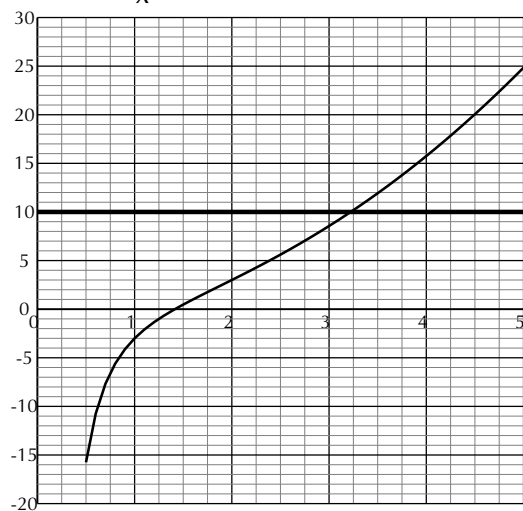


b) $y = x^2 - \frac{1}{x^2}$

x	0.5	1	1.5	2	3	4	5
y	-3.8	0.0	1.8	3.8	8.9	15.9	25.0

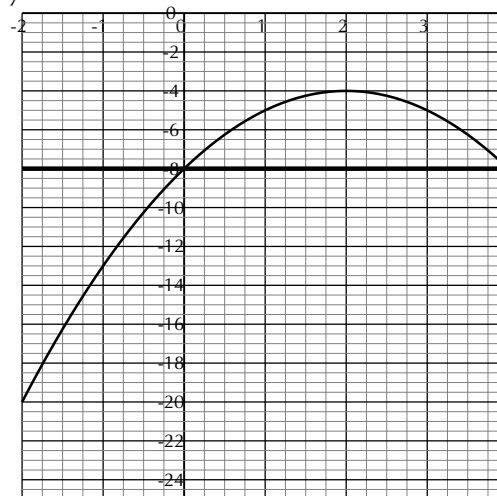


2: a) $y = x^2 - \frac{4}{x^2}$



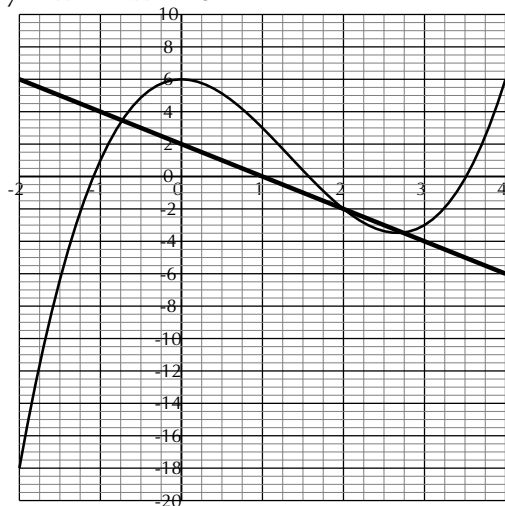
$y = 10$ at: $x \approx 3.2$.

b) $y = -x^2 + 4x - 8$



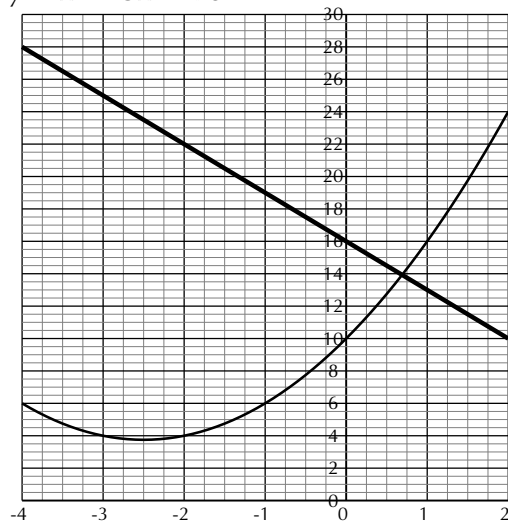
$y = -8$ at: $x \approx 0.0$, $x \approx 4.0$.

3: a) $y = x^3 - 4x^2 + 6$



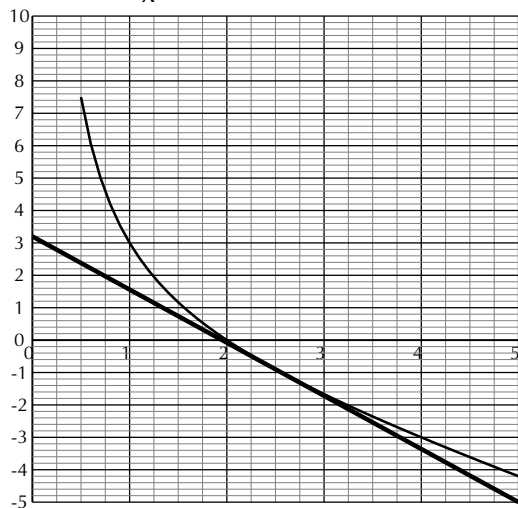
$y = -2x + 2$ at: $x \approx -0.7$, $x \approx 2.0$, $x \approx 2.7$.

b) $y = x^2 + 5x + 10$



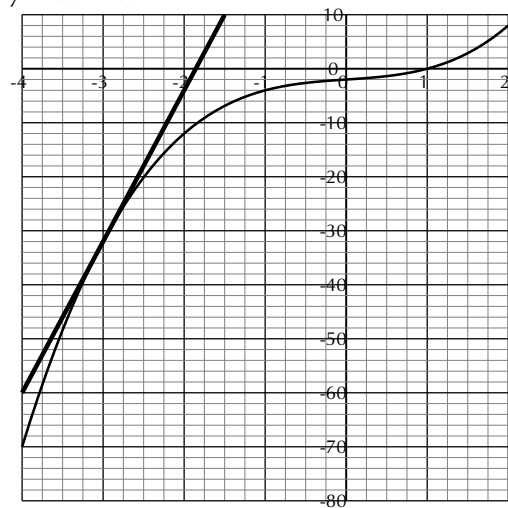
$y = -3x + 16$ at: $x \approx 0.7$.

4: a) $y = -x + \frac{4}{x}$



Gradient at $x = 2.5$ is ≈ -1.6 .

b) $y = x^3 + x - 2$



Gradient at $x = -3$ is ≈ 28 .

Surds - consolidation work

MATHSprint

Answer on separate paper

1: Simplify the following surds:

a) $\sqrt{96}$

b) $\sqrt{27}$

2: Simplify the following surds:

a) $\sqrt{75} - \sqrt{48}$

b) $\sqrt{50} + \sqrt{2}$

3: Simplify the following surds:

a) $\sqrt{90} \times \sqrt{10}$

b) $\sqrt{3} \times \sqrt{18}$

4: Simplify the following surds:

a) $\sqrt{80} \div \sqrt{5}$

b) $\sqrt{28} \div \sqrt{7}$

5: Simplify the following surds:

a) $\sqrt{3}(4 + \sqrt{3})$

b) $\sqrt{5}(5 - \sqrt{5})$

6: Simplify the following surds:

a) $(6 - \sqrt{7})^2$

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

7: Simplify the following surds:

a) $(2 + 3\sqrt{6})(1 + 2\sqrt{6})$

b) $(6 + 2\sqrt{10})(3 - 4\sqrt{10})$

8: Simplify the following surds:

a) $(2 - 4\sqrt{5})(5 + 3\sqrt{6})$

b) $(1 - 5\sqrt{2})(4 - \sqrt{3})$

9: Simplify the following surds:

a) $(\sqrt{10} + 2\sqrt{7})^2$

b) $(2\sqrt{6} - 4\sqrt{5})^2$

10: Simplify the following surds:

a) $\frac{9}{\sqrt{7}}$

b) $\frac{4}{\sqrt{3}}$

11: Simplify the following surds:

a) $\frac{1}{1 + \sqrt{7}}$

b) $\frac{1}{4 - \sqrt{7}}$

12: Simplify the following surds:

a) $\frac{5}{6 + 4\sqrt{2}}$

b) $\frac{2}{10 + 7\sqrt{2}}$

13: Simplify the following surds:

a) $\frac{1}{\sqrt{5} - 2\sqrt{2}}$

b) $\frac{1}{\sqrt{14} - 2\sqrt{3}}$

14: Simplify the following surds:

a) $\frac{3 + 2\sqrt{6}}{5 + 2\sqrt{6}}$

b) $\frac{2 - 4\sqrt{10}}{7 + 2\sqrt{10}}$

Answers: Surds - consolidation work

MATHSprint

1: a) $4\sqrt{6}$

b) $3\sqrt{3}$

2: a) $\sqrt{3}$

b) $6\sqrt{2}$

3: a) 30

b) $3\sqrt{6}$

4: a) 4

b) 2

5: a) $4\sqrt{3} + 3$

b) $5\sqrt{5} - 5$

6: a) $43 - 12\sqrt{7}$

b) $11 + 6\sqrt{2}$

7: a) $2 + 4\sqrt{6} + 3\sqrt{6} + 36$
 $= 38 + 7\sqrt{6}$

b) $18 - 24\sqrt{10} + 6\sqrt{10} - 80$
 $= -62 - 18\sqrt{10}$

8: a) $10 + 6\sqrt{6} - 20\sqrt{5} - 12\sqrt{30}$

b) $4 - \sqrt{3} - 20\sqrt{2} + 5\sqrt{6}$

9: a) $10 + 2\sqrt{70} + 2\sqrt{70} + 28$
 $= 38 + 4\sqrt{70}$

b) $24 - 8\sqrt{30} - 8\sqrt{30} + 80$
 $= 104 - 16\sqrt{30}$

10: a) $\frac{9}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = \frac{9\sqrt{7}}{7}$

b) $\frac{4}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{4\sqrt{3}}{3}$

11: a) $\frac{1}{1 + \sqrt{7}} \times \frac{1 - \sqrt{7}}{1 - \sqrt{7}}$
 $= \frac{1 - \sqrt{7}}{1 - 7}$
 $= \frac{1 - \sqrt{7}}{-6} = \frac{-1 + \sqrt{7}}{6}$

b) $\frac{1}{4 - \sqrt{7}} \times \frac{4 + \sqrt{7}}{4 + \sqrt{7}}$
 $= \frac{4 + \sqrt{7}}{16 - 7}$
 $= \frac{4 + \sqrt{7}}{9}$

12: a) $\frac{5}{6 + 4\sqrt{2}} \times \frac{6 - 4\sqrt{2}}{6 - 4\sqrt{2}}$
 $= \frac{30 - 20\sqrt{2}}{36 - 32}$
 $= \frac{30 - 20\sqrt{2}}{4} = \frac{15 - 10\sqrt{2}}{2}$

b) $\frac{2}{10 + 7\sqrt{2}} \times \frac{10 - 7\sqrt{2}}{10 - 7\sqrt{2}}$
 $= \frac{20 - 14\sqrt{2}}{100 - 98}$
 $= \frac{20 - 14\sqrt{2}}{2} = 10 - 7\sqrt{2}$

13: a) $\frac{1}{\sqrt{5} - 2\sqrt{2}} \times \frac{\sqrt{5} + 2\sqrt{2}}{\sqrt{5} + 2\sqrt{2}}$
 $= \frac{\sqrt{5} + 2\sqrt{2}}{5 - 8}$
 $= \frac{\sqrt{5} + 2\sqrt{2}}{-3} = \frac{-\sqrt{5} - 2\sqrt{2}}{3}$

b) $\frac{1}{\sqrt{14} - 2\sqrt{3}} \times \frac{\sqrt{14} + 2\sqrt{3}}{\sqrt{14} + 2\sqrt{3}}$
 $= \frac{\sqrt{14} + 2\sqrt{3}}{14 - 12}$
 $= \frac{\sqrt{14} + 2\sqrt{3}}{2}$

14: a) $\frac{3 + 2\sqrt{6}}{5 + 2\sqrt{6}} \times \frac{5 - 2\sqrt{6}}{5 - 2\sqrt{6}}$
 $= \frac{15 - 24 + 10\sqrt{6} - 6\sqrt{6}}{25 - 24}$
 $= \frac{-9 + 4\sqrt{6}}{1} = -9 + 4\sqrt{6}$

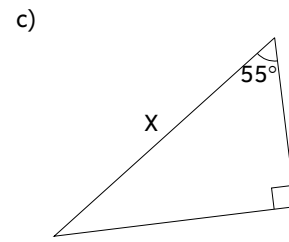
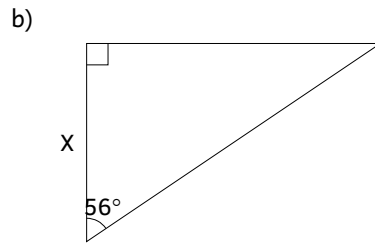
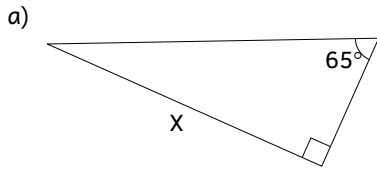
b) $\frac{2 - 4\sqrt{10}}{7 + 2\sqrt{10}} \times \frac{7 - 2\sqrt{10}}{7 - 2\sqrt{10}}$
 $= \frac{14 + 80 - 28\sqrt{10} - 4\sqrt{10}}{49 - 40}$
 $= \frac{94 - 32\sqrt{10}}{9}$

Starting Trigonometry - sheet A

MATHSprint

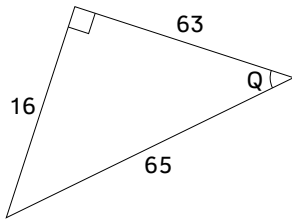
Please answer in your books

1: Give the name of the side marked X:

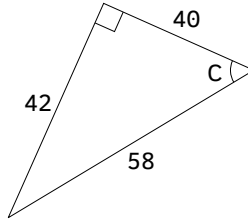


2: Find the following (answer as a simplified fraction):

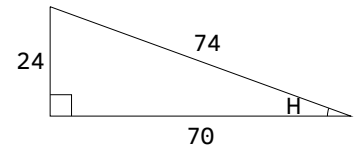
a) $\cos(Q)$



b) $\tan(C)$



c) $\sin(H)$



3: Work out the value of the following (correct to 3 sig figs):

a) $\cos(9^\circ)$

b) $\sin(16^\circ)$

c) $\tan(39^\circ)$

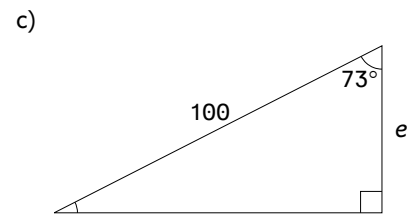
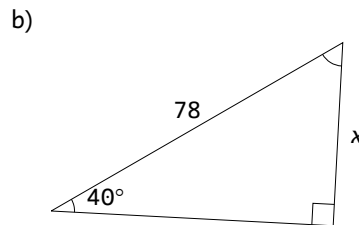
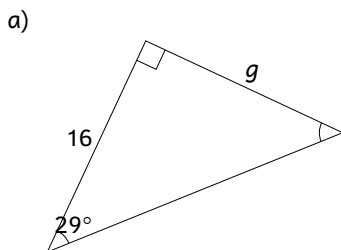
4: Work out the value of the following (correct to 3 sig figs):

a) $\cos^{-1}(0.778)$

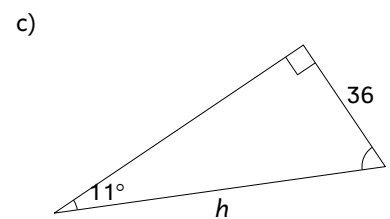
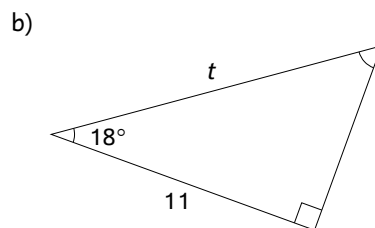
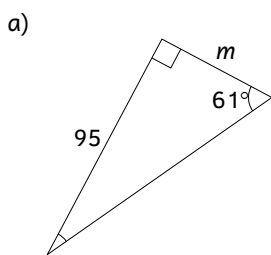
b) $\sin^{-1}(0.948)$

c) $\tan^{-1}(0.14)$

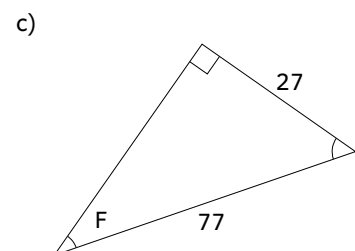
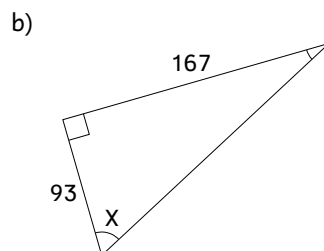
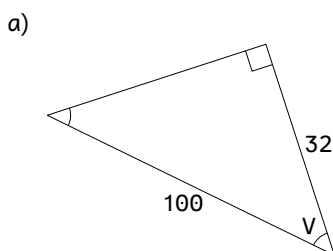
5: Find the unknown quantity (correct to 1 decimal place):



6: Find the unknown quantity (correct to 1 decimal place):



7: Find the unknown quantity (correct to 1 decimal place):



Answers: Starting Trigonometry - sheet A

MATHSprint

1: a) Opposite b) Adjacent c) Hypotenuse

2: a) $\frac{63}{65}$ b) $\frac{21}{20}$ c) $\frac{12}{37}$

3: a) 0.988 b) 0.276 c) 0.810

4: a) 38.9° b) 71.4° c) 7.97°

5: a) $g = 8.9$ b) $x = 50.1$ c) $e = 29.2$

6: a) $m = 52.7$ b) $t = 11.6$ c) $h = 188.7$

7: a) $V = 71.3^\circ$ b) $X = 60.9^\circ$ c) $F = 20.5^\circ$

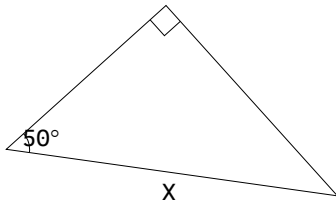
Starting Trigonometry - sheet B

MATHSprint

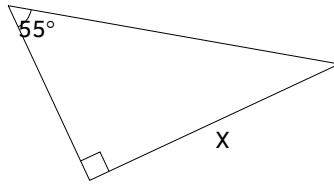
Please answer in your books

1: Give the name of the side marked X:

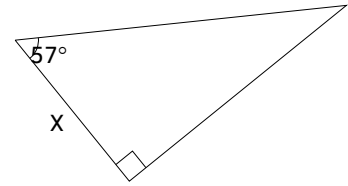
a)



b)

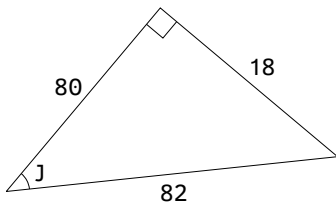


c)

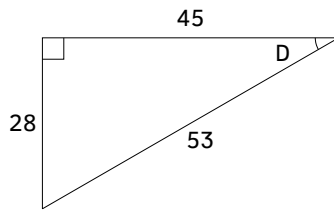


2: Find the following (answer as a simplified fraction):

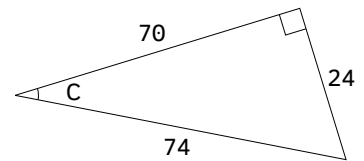
a) $\tan(J)$



b) $\sin(D)$



c) $\cos(C)$



3: Work out the value of the following (correct to 3 sig figs):

a) $\sin(49^\circ)$

b) $\tan(57^\circ)$

c) $\cos(5^\circ)$

4: Work out the value of the following (correct to 3 sig figs):

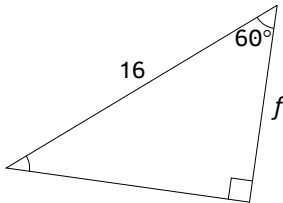
a) $\cos^{-1}(0.833)$

b) $\sin^{-1}(0.773)$

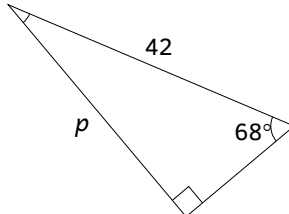
c) $\tan^{-1}(0.35)$

5: Find the unknown quantity (correct to 1 decimal place):

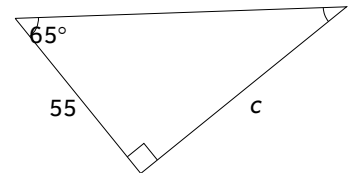
a)



b)

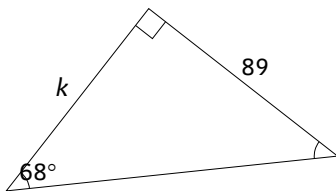


c)

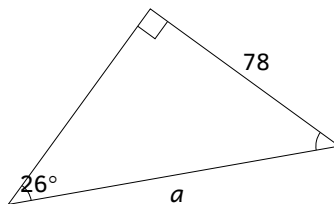


6: Find the unknown quantity (correct to 1 decimal place):

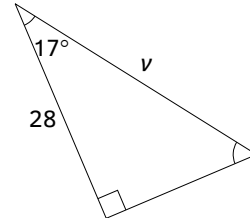
a)



b)

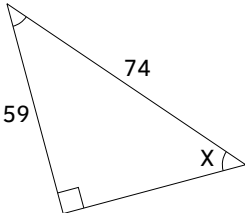


c)

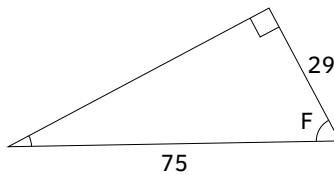


7: Find the unknown quantity (correct to 1 decimal place):

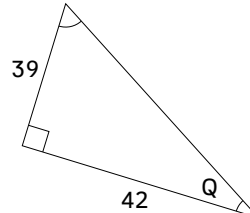
a)



b)



c)



Answers: Starting Trigonometry - sheet B

MATHSprint

1:	a) Hypotenuse	b) Opposite	c) Adjacent
2:	a) $\frac{9}{40}$	b) $\frac{28}{53}$	c) $\frac{35}{37}$
3:	a) 0.755	b) 1.54	c) 0.996
4:	a) 33.6°	b) 50.6°	c) 19.3°
5:	a) $f = 8.0$	b) $p = 38.9$	c) $c = 117.9$
6:	a) $k = 36.0$	b) $a = 177.9$	c) $v = 29.3$
7:	a) $X = 52.9^\circ$	b) $F = 67.3^\circ$	c) $Q = 42.9^\circ$