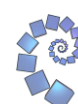The links for the Assignment number take you to the pdf of the assignment. For more information on each one, and links to the solutions documents go to https://maths.org/step/assignments.

Warm-ups are often proof or derivations of results needed for the STEP question (or just for interest).

Warm downs often have famous historical maths problems, and introductions to other areas of maths.

	Warm up	STEP Q	Q 2 and 3 content	Warm down
FA1	Surd manipulation	2005 S1 Q3	Solutions of fractional equations/repeated roots quadratics	Area between two circles
FA2	Algebraic simplification	1999 S1 Q6	Max and min of $bx + a$ and $cx^2 + bx + a$	Logic puzzle
FA3	Introduction to sigma, and sum of GP	2004 S1 Q2	Floor function, and integrals as area under graph. Use of GP sum	Diophantine equations ([Monkeys and Coconuts](#))
FA4	Proof angle at centre of circle is twice angle at edge	1995 S1 Q1	Cubic inequality and inequality in two variables ($x^3 - 4x^2y - xy^2 + 4y^3 \geq 0$)	Logic puzzles
FA5	Derivation of cosine rule	2006 S1 Q8	Volume of a tetrahedron (vectors, and be careful with names of sides!) Uses cosine rule	Drawer of red and blue socks
FA6	Simplifying fraction, and solving 3x3 sim equations	2005 S1 Q1	Arrangements (examples in Q5). How many 5 digit numbers where digit sum if 39?	Conditional probability (If +ve test, what prob have it?)
FA7	Graph sketching, and solving ineqs	2002 S1 Q5	Roots of equations/solving a quartic	Bachet's Weights Problem (connection to binary/ternary)
FA8	Derivation of AM-GM for 2, 4 and 3 values	2002 S1 Q1	Circle passing through intersection of 2 ellipses	Socks – three colours now.
FA9	Proof of base angles isos tri, area of a tri and sine rule, $\sin(2a)$	1993 S1 Q7	Sketch of cubic and how conditions on the coefficients affect number of roots	"[Bridge of donkeys](#)" Euclid proof of base angles
FA10	Derivation of $\sin(A \pm B)$ and $\cos(A \pm B)$	2005 S2 Q2	Euler totient function – includes discussion and examples of "if" and "only if" and "iff"	Questions from 1858 UCLES paper
FA11	Recursive sequence and sketching a periodic function	2013 S1 Q1	Using substitutions to solve equations (and being careful about added rogue solutions from squaring)	Equations with indices

FA12	Divisibility (of $n^3 - n$, $n^5 - n^3$)	2011 S1 Q12	Probability (equally likely outcomes)	Bellringing problem (prime factorization!)
FA13	Convex/concave/points of inflection (including non-stationary)	2012 S1 Q2	Curve sketching and numbers of roots (vertical translations of graph)	linear Diophantine equation
FA14	Sum and difference of two cubes	2010 S2 Q3	Fibonacci numbers explicit formula. Involves surd manipulation, rationalizing denominator and inf GP sum	Kirkman's schoolgirl problem
FA15	Solving a quartic, product notation	2006 S2 Q1	Periodicity of sequences, and limits of convergent ones	Crossing the desert with a limited amount of fuel
FA16	Functions (including some of two variables)	2015 S1 Q2	Solving a cubic through trig identities – those from FA10	"Proof" that all triangles are isosceles
FA17	Modular arithmetic	2003 S1 Q1	Sums of squares and cubes	Modular arithmetic and divisibility
FA18	Curve Sketching	2014 S1 Q3	Integral equation and conditions on limits	Koch snowflake fractal
FA19	Derivation of small angle trig approximations	2005 S1 Q6	Loci of a point (some extended algebra)	2 probability questions.
FA20	Derivation of derivatives of sin x, cos x, ln x	1996 S2 Q3 AND 2006 S3 Q8	Proof by induction: 1996 S2 Q3: Fibonacci 2006 S3 Q8: Polynomial differentiation	Geometry triangle question
FA21	Introduction to hyperbolics (sudo-hyperbolic functions)	1999 S1 Q4	Modulus graph sketching (also uses translations of graphs)	2 geometry problems. 2nd uses similar tris
FA22	Derivation of product rule (diff), and derivative of e^x	2015 S1 Q1	Curve sketching, roots and graph of f(x^2)	Euler's polyhedra formula
FA23	Derivation of chain rule (diff)	2009 S1 Q8	Lines touching circle, and equation of the incircle	Blue eyed islander induction problem
FA24	"anti-differentiation" and integration by parts	1998 S2 Q4	Recursive integral (I_n)	Basel Problem – sum of $\frac{1}{n^2}$
FA25	Integration by substitution	1994 S1 Q8	Integration questions	More integration ("tricks")

[Mixed Pure Questions](maths.org/step)

2012 S1 Q4: Tangents and normal to curve and where they meet
2012 S1 Q8: Solving differential equations with a substitution
2010 S1 Q5: Binomial expansions
2014 S1 Q1: Number theory/proof
2005 S1 Q4: Solving Trig equations
2013 S1 Q3: Vectors and a binary operation. Point on a line
2008 S1 Q4: Convex functions (differentiation, product rule)
2013 S1 Q7: Solving differential equations by substitution

[Mixed Statistics Questions](maths.org/step)

2010 S1 Q12: Expectation (penguins in cereal boxes)
2009 S1 Q13: Probability and arrangements, and expectation
1995 S1 Q12: Arrangements and probability
1999 S2 Q12: Conditional probability and Bayes theorem
2006 S2 Q13: Probability of choosing the biggest ice cream
2008 S2 Q13: Black and white counters in a bag
2015 S2 Q12: Coin tossing game

[Mixed Statistics Questions](maths.org/step)

2012 S1 Q11: Pulley problem, with two slopes
2010 S1 Q10: Particle moving in two dimensions, velocity and acceleration
1993 S1 Q11: Centre of mass of a wire shape
2006 S2 Q11: Projectile, with wind resistance
2008 S2 Q11: Particle on a wedge. Wedge can move as particle slides down