



ARCHITECTURAL DRAFTING 15.1303.00

EMBEDDED MATH CREDIT CROSSWALK

The Architectural Drafting program has been recognized by the Arizona State Board of Career and Technical Education (CTE) is eligible for consideration by local governing boards to grant 1 credit of 4th-year high school math. This document is the result of a committee analysis completed in 2021.

Note: AZ High School Math Standards are highlighted.

STANDARD 1.0 APPLY MEASUREMENT AND SCALE CONCEPTS IN DESIGN DRAFTING

- 1.1 Compare types of measurement instruments used by architects and engineers (e.g., architectural scale and engineering scale)
Geometry G.G-MG.A.3 Apply geometric methods to solve design problems utilizing real-world context.
Rationale: Use proportions and conversions to scale up/down measurements.
- 1.2 Perform field measurements with handheld instruments (i.e., tape measure, lasers, digital applications, electronic measuring tools, etc.)
Geometry G.G.CO.D.12 Make formal geometric constructions with a variety of tools and methods. Constructions include copying segments, copying angles; bisecting segments; bisecting angles; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.
Geometry G.G.CO.D.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle; with a variety of tools and methods.
Geometry G.G-MG-A.1 Use geometric shapes, their measures, and the properties to describe objects utilizing real-world context.
Rationale: Use geometric constructions to bisect a line, draw shapes, angles, and parallel lines (computer-aided and sketching). Use architectural scales, proportions, conversions to scale up/down measurements.
- 1.3 Select and apply the appropriate scale for viewing information and drawings (i.e., readability, etc.)
Geometry GN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities utilizing real-world content.
Rationale: Determine what scale to use based on drawing analysis.
- 1.4 Transcribe illustrations and/or field measurements accurately to a scale
Geometry GN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data.
Geometry GN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities utilizing real-world content.
Rationale: Document accuracy of the scale.
- 1.5 Verify interior dimensions for spatial awareness
Geometry G.G.CO.D.12 Make formal geometric constructions with a variety of tools and methods. Constructions include: copying segments, copying angles; bisecting segments; bisecting angles; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.
Geometry G.G.CO.D.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle; with a variety of tools and methods.
Geometry GN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities utilizing real-world content.
Rationale: Design room interior using standard sizing and bubble area diagrams.
Shape properties to fit.
- 1.6 Assess measurements for accuracy by documenting existing conditions (i.e., photographs, portable drones, etc.)
Geometry G.G-MG-A.1 Use geometric shapes, their measures, and the properties to describe objects utilizing real-world context.
Geometry G.G-MG.A.3 Apply geometric methods to solve design problems utilizing real-world context. Using tools to measure and document.

Rationale: Use architectural scales, proportions, and conversions to scale up/down measurements.

STANDARD 2.0 INTERPRET TECHNICAL DOCUMENTS AND BUILDING SPECIFICATIONS USED BY ARCHITECTS AND ENGINEERS

- 2.1 Interpret dimensions, symbols, legends, scales, and directions/orientations
- 2.2 Read and interpret content and information communicated in schematics (preliminary concept) and technical drawings
- 2.3 Locate and interpret information on specific documents (i.e., schedules, existing drawings, reference callouts, plan notes, cut sheets, etc.)
- 2.4 Analyze schematics (preliminary concept) and technical drawings for clarity, completeness, and accuracy
- 2.5 Recognize cross-referencing on technical drawings (e.g., sections, elevations, and details related to a floor plans and roof plan)
- 2.6 Identify and describe basic types of drawings by trade (e.g., architecture, mechanical, structural, electrical, plumbing, HVAC, and civil engineering systems)
- 2.7 Verify and justify documents for dimensional accuracy, completeness, and details (i.e., plans, elevations, doors, windows, etc.)
- 2.8 Compare schematics to technical drawings (i.e., isometric schematic related to electrical plans, plumbing plans, etc.)
- 2.9 Interpret legal land descriptions (i.e., ALTA, GIS, plat maps, etc.) needed for a site plan
- 2.10 Verify state, county, local, and national building standards, codes, and regulations used in architectural drafting (i.e., ADA, ANSI, etc.)
- 2.11 Apply appropriate specifications for project-specific jobs (i.e., CSI format, outline, drawing, etc.)

STANDARD 3.0 UTILIZE HARDWARE AND SOFTWARE TOOLS INCLUDING BASIC COMPUTER CONCEPTS, OPERATIONS, AND TECHNOLOGY APPLICATIONS

- 3.1 Use computer hardware/software for design drafting solutions
- 3.2 Apply electronic file management techniques (e.g., consistency, folders/subfolders, reference files, PDFs, simple/intuitive naming, and follow through)
- 3.3 Maintain electronic file management techniques (e.g., archiving, file cleanup, and void folders)
- 3.4 Use various formats (e.g., dxf, dxb, Tiff, gif, pcx, eps, spd, and pdf) to import and export data files
- 3.5 Prepare files for electronic transfer and/or storage
- 3.6 Use the Internet, Intranet, and/or third-party file transfer/storage programs (i.e., FTP, Cloud, etc.)

STANDARD 4.0 UTILIZE COMPUTER-AIDED SOFTWARE SYSTEMS FOR PROJECT MANAGEMENT

- 4.1 Compare and contrast services and processes provided by CADD, VDCM, and BIM systems
- 4.2 Determine the program to analyze drawings (e.g., CADD, VDCM, or BIM)
- 4.3 Use CADD, VDCM, and BIM software functions and commands to set up drawing scale, format, dimensioning, etc.
- 4.4 Apply item properties, colors, line types, editing commands, text styles, and grouping techniques
- 4.5 Incorporate standard parts, symbol libraries, and/or templates
- 4.6 Control viewing commands (i.e., setting scale, title block, view reference, sheet layout, cartoon set, sheet organization, etc.)
- 4.7 Characterize the difference between model space and paper space to determine scale using computer-aided software

Geometry G.N-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays, include utilizing real-world context.

Geometry G.N-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

Geometry G.N-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities utilizing real-world context.

Rationale: Use scale and proportions.

STANDARD 5.0 DETERMINE THE TYPES AND COMPONENTS OF BUILDING SYSTEMS

- 5.1 Identify the components of a site plan (i.e., property lines, utility access, setbacks, easements, landscaping, contour and topography lines, etc.)
- 5.2 Identify different types/parts of foundations/footings (i.e., concrete slabs, stem walls, masonry, rebar, crushed rock, etc.)
- 5.3 Identify different types/parts of plans (i.e., first level, upper level, basement, finish, dimension, equipment, demolition, electrical, HVAC, reflected ceiling, etc.)

- 5.4 Identify different types of floor structures/systems (i.e., framing, wood or steel trusses/joists, sheathing, wood or steel beams, i-joists, concrete, girders, etc.)
- 5.5 Examine types of walls [i.e., architectural and structural stud walls (steel or wood), masonry, concrete, fire, etc.]
- 5.6 Distinguish components of a wall (i.e., sheathing, sheathing, insulation, air space, vapor barrier, stud spacing, bracing, tie-/hold-downs, etc.)
- 5.7 Identify parts of a staircase systems (i.e., treads, risers, stringers, handrails, landing, railing, structural support, steel/wood, cast in place, precast, etc.)
- 5.8 Identify parts of ramp systems (i.e., support walls, handrails, landing, railing, steel/wood, concrete, etc.)
- 5.9 Identify types of roofs (i.e., pitched, inverted pitch, flat, shed, gable, barrel, etc.)
- 5.10 Identify components of roofs (i.e., tile, membrane, shingles, framing, wood or steel trusses/joists, wood or steel beams, i-joists, concrete, girders, rigid insulation, rafters, steel decking, wood/gypsum sheathing, etc.)

STANDARD 6.0 PRODUCE TECHNICAL DRAWINGS

- 6.1 Use fundamental drafting techniques for drawings
- 6.2 Demonstrate freehand lettering technique (i.e., all uppercase without slant)
- 6.3 Determine correct line types and line weights (i.e., when to use heavy, solid, dotted, hidden, etc.)
- 6.4 Create title blocks
- 6.5 Format a sheet set (i.e., sequence number, deciding numbering system to be consistent within the project, etc.)
- 6.6 Apply notes/annotations and dimensions as appropriate and required
- 6.7 Plot, print, or create digital drawings (i.e., PDF, etc.)
- 6.8 Organize a sequence of drawings and supporting documents [i.e., narrative (standards used), calculation, etc.]

STANDARD 7.0 APPLY DESIGN DRAFTING CONCEPTS AS RELATED TO ARCHITECTURAL DESIGN

- 7.1 Prepare a foundation or basement plan

Geometry G.G-GPE.B.7 Uses coordinates to compute perimeters of polygons and areas of triangles and rectangles.

Geometry G.G-MG-A.1 Use geometric shapes, their measures, and the properties to describe objects utilizing real-world context.

Geometry G.G-MG.A.3 Apply geometric methods to solve design problems utilizing real-world context.

Rationale: Analyze shapes, spatial features, lines angles, and shapes to create plans. Perform linear measurements and area, coordinate systems, modeling.

- 7.2 Prepare a floor plan or model from a preliminary sketch

Geometry G.G-GPE.B.7 Uses coordinates to compute perimeters of polygons and areas of triangles and rectangles.

Geometry G.G-MG-A.1 Use geometric shapes, their measures, and the properties to describe objects utilizing real-world context.

Geometry G.G-MG.A.3 Apply geometric methods to solve design problems utilizing real-world context.

Rationale: Analyze shapes and spatial features – similar to 7.1.

- 7.3 Prepare roof details (i.e., roof drain schedules, gutter details, roof flashing, scupper details, roof vent, pitch calculation, flat, tile, etc.)

Geometry G.G-GPE.B.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems, including finding the equation of a line parallel or perpendicular to a given line that passes through a given point.

Geometry G.G-SRT.C.8 Use trigonometric ratios (including inverse trigonometric ratios) and the Pythagorean Theorem to find unknown measurements in right triangles utilizing real-world context.

Rationale: Create plans according to spatial features, slopes, lines, angles, and shapes. Perform linear measurements and area, coordinate systems, and modeling. Understand the difference of perpendicular and parallel lines. Calculate angles with the Pythagorean theorem.

- 7.4 Prepare an electrical plan locating receptacle, switch, and lighting fixtures

Geometry G.G-GPE.B.7 Uses coordinates to compute perimeters of polygons and areas of triangles and rectangles

Geometry G.G-MG-A.1 Use geometric shapes, their measures, and the properties to describe objects utilizing real-world context.

Geometry G.G-MG.A.3 Apply geometric methods to solve design problems. utilizing real-world context.

Rationale: Analyze shapes, spatial features, lines angles, and shapes to create plans. Perform linear measurements and area, coordinate systems, modeling. Similar to 7.1

- 7.5 Prepare a plumbing plan showing fixture locations and floor drains

Geometry G.G-MG.A.3 Apply geometric methods to solve design problems utilizing real-world context.

Rationale: Measure 3D height and create isometric drawings.

- 7.6 Prepare a basic HVAC plan locating air handlers, condensers, duct returns, return plenum, transfer ducts, and diffusers (vents)
- 7.7 Prepare drawings of four exterior elevations (e.g., north, east, south, and west) including keynote elements (i.e., dimension any special elements, provide building height, material finishes, etc.)
- 7.8 Identify and prepare the components of door and window schedules
- 7.9 Assemble a set of working drawings for a residential or small commercial structure
- 7.10 Prepare site plan [i.e., drain and drainage, site walls (block, fencing), utility lines, easement, setbacks, stairs, sidewalks, etc.]
- 7.11 Prepare a landscape plan including vegetation, irrigation, and retention basins [i.e., NAOS (natural area open space), sidewalks, etc.]

STANDARD 8.0 PREPARE DRAWINGS OF SECTIONS AND DETAILS

- 8.1 Create and place one North/South and one East/West cross section on a plan
- 8.2 Create a larger scale detail of one area of a cross section/detail (i.e., end of full height wall section, etc.)
- 8.3 Create plan details (i.e., enlarged floor plans of restrooms, column details, any unique detail to show architectural intent for the contractor, reflected ceiling details of soffits or coves, etc.)
- 8.4 Identify parts and pieces for detailed drawings (i.e., leaders, keynotes, texts, descriptive terms, sequencing, major components, etc.)

STANDARD 9.0 CREATE PICTORIAL DRAWINGS, MODELS, AND RENDERINGS

- 9.1 Create isometric or perspective drawings using manual and/or electronic techniques

Geometry G.G-MG.A.3 Apply geometric methods to solve design problems utilizing real-world context.

Rationale: Create and interpret 3D drawings.

- 9.2 Select appropriate materials and properties to apply to the entities (i.e., textures, concrete vs. stucco, glass, metals, etc.)
- 9.3 Render a model to create a presentation drawing (i.e., shadowing, coloring, lighting, shading, camera perspective, vanishing points, etc.)
- 9.4 Create video of rendered model (i.e., fly-thru, exterior aerial views, animation, etc.)