

***CTE Standards Unpacking
Intro to Drafting and Design***

Course: Intro to Drafting and Design

Course Description: People with careers in design and pre-construction create our future. They turn a concept into a set of plans whether for a component, a system, or a building. Their plans guide other construction or manufacturing professionals as they continue the building process. This course will expose students to the American Design Drafting Association (ADDA) Apprentice standards in both mechanical and architectural drafting. The desire for this course is for the students to receive industry based training at the basic level before taking either the Mechanical or Architectural drafting courses. It is highly recommended that students have taken Algebra I and Geometry before taking this course.

Career Cluster: Architecture & Construction

Prerequisites: Algebra I and Geometry Recommended

Program of Study Application: Introduction to Drafting and Design is an introductory course in the Architectural Drafting and Design/Pre-Construction Pathways. This course follows foundational CTE courses, and is designed to prepare individuals to participate successfully in pathway courses in the Design/Pre-Construction, Construction, or Maintenance/Operations pathways.

INDICATOR #IDD 1: Examine basic drafting terminology and equipment.		
SUB-INDICATOR 1.1 (Webb Level: 1 Recognize): Recognize basic drafting terms and abbreviations.		
SUB-INDICATOR 1.2 (Webb Level: 2 Differentiate): Differentiate basic drafting tools and their uses.		
<p>Knowledge (Factual):</p> <ul style="list-style-type: none"> • Drafting Terms • Appropriate applications of the terminology • Names of tools • Uses of tools • General office equipment and tier usages (printers, plotters, copiers) • Different media types-(current & historical) • Primary information storage device on a CAD system 	<p>Understand (Conceptual):</p> <ul style="list-style-type: none"> • The importance of using the proper drafting terms • Proper way to use tools • Different ways to use the same tool 	<p>Skills (Application):</p> <ul style="list-style-type: none"> • Identify tools • Show proper ways to use tools • Show how to maintain tools • Identify Architectural paper and sizes and their uses

<ul style="list-style-type: none"> • Components of a computer that apply to CAD drafting 		
<p>Benchmarks <i>Students will be assessed on their ability to:</i></p> <ul style="list-style-type: none"> • Identify and explain the use of basic drafting tools with 90% accuracy. • ADDA Apprentice Drafting Competencies met: Mechanical #1. • ADDA Apprentice Drafting Competencies met: Mechanical #2, Architecture #2. 		
<p>Academic Connections</p>		
<p>ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):</p> <p>RI4.Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text</p> <p>RI7.Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.</p>	<p>Sample Performance Task Aligned to the Academic Standard(s): Students be able to define the basic drafting terms and abbreviations.</p>	
<p>Indicator #IDD 2: Apply basic math skills to design work.</p>		
<p>SUB-INDICATOR 2.1 (Webb Level: 2 Apply): Apply algebraic and trigonometric formulas used in drafting and design.</p>		
<p>SUB-INDICATOR 2.2 (Webb Level: 2 Understand): Understand the various drawing scales used in drafting.</p>		

<p>Knowledge (Factual):</p> <ul style="list-style-type: none"> • Add, subtract, multiply and divide whole numbers, fractions, and decimals • Convert fractions to decimal equivalents • Convert decimal values to nearest fractional equivalent • Scales used in drafting • 	<p>Understand (Conceptual):</p> <ul style="list-style-type: none"> • Volume formulas • Area formulas • Pythagorean Theorem • Basic Trigonometric formulas (sine, tangent, cosine, inverse) functions • When to use the different drafting scales • Conversion of actual lengths to typical technical drawing scale factors 	<p>Skills (Application):</p> <ul style="list-style-type: none"> • Solve for an unknown angle • Calculate area • Calculate volume • Solve for unknown sides • Reduce a drawing by scaling down to fit on assigned paper size • Convert a drawing with fractions into decimal equivalents • Use various scales to divide a line equally
<p>Benchmarks</p> <p><i>Students will be assessed on their ability to:</i></p> <ul style="list-style-type: none"> • ADDA Apprentice Drafting Competencies met: Mechanical #13, Architecture #5 • Draw to scale and solve mathematical conversions accurately 		
<p><i>Academic Connections</i></p>		
<p>ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):</p> <p>GSRT8 – Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.</p> <p>G-SRT1 – Verify experimentally the properties of dilations given by a center and a scale factor.</p>	<p>Sample Performance Task Aligned to the Academic Standard(s):</p> <p>Students will create a drawing to the correct scale according to the sheet size provided.</p>	

<p>Indicator #IDD 3: Examine basic drafting fundamental and technical skills</p>		
<p>SUB-INDICATOR 3.1 (Webb Level: 3 Integrate): Integrate symbols, lettering and Geometric shapes used on technical drawings.</p>		
<p>SUB-INDICATOR 3.2 (Webb Level: 1 Illustrate): Illustrate line types recommended by American National Standards Institute (ANSI).</p>		
<p>SUB-INDICATOR 3.3 (Webb Level: 1 Define): Define dimensioning styles and techniques on metric and imperial drawings.</p>		
<p>Knowledge (Factual):</p> <ul style="list-style-type: none"> • American National Standard Institute (ANSI) 31 • Correct geometric construction techniques • Line types • Line weights • Line styles • Line hierarchy • Dimension styles (tabular, chain, horizontal, linear aligned, linear vertical, angular) • 	<p>Understand (Conceptual):</p> <ul style="list-style-type: none"> • Proper lettering size for CAD drawing • Proper lettering size for hand drawn text • Correct application of lines • Best location for dimensions • ANSI standards for dimensioning and notes 	<p>Skills (Application):</p> <ul style="list-style-type: none"> • Create the basic geometric shapes using manual drafting tools • Combine various drafting tools to define angles and directions • Demonstrate the different line types • Dimension a part • Correctly use leaders and notes
<p>Benchmarks <i>Students will be assessed on their ability to:</i></p> <ul style="list-style-type: none"> • Properly illustrate drawings using the correct geometric shapes and lettering • ADDA Apprentice Drafting Competencies met: Mechanical #3 • Ensure an accurate portrayal of the drawing and construction of a project using proper line types and weights • ADDA Apprentice Drafting Competencies met: Mechanical #4, Architecture #4 • Produce quality drawings using proper dimensioning styles and techniques • ADDA Apprentice Drafting Competencies met: Mechanical #4 		

<i>Academic Connections</i>	
<p>ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):</p> <p>RI4. Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text</p> <p>RI7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.</p> <p>G-MG1. Use geometric shapes, their measures, and their properties to describe Objects</p> <p>G-MG3 - Apply geometric methods to solve design problems</p>	<p>Sample Performance Task Aligned to the Academic Standard(s):</p> <p>Students will follow the dimensioning rules to correctly dimension their drawing.</p>

Indicator #IDD 4: Apply drawing techniques to produce various technical plans.		
SUB-INDICATOR 4.1 (Webb Level: 4 Create): Create orthographic projections.		
SUB-INDICATOR 4.2 (Webb Level: 4 Create): Create isometric and pictorial drawings.		
<p>Knowledge (Factual):</p> <ul style="list-style-type: none"> • Rules for selecting the number of required views • Rules for selecting 	<p>Understand (Conceptual):</p> <ul style="list-style-type: none"> • Normal and oblique surfaces • Understand the use of oblique (cabinet 	<p>Skills (Application):</p> <ul style="list-style-type: none"> • Create normal and oblique surfaces • Create

<p>the proper front view</p> <ul style="list-style-type: none"> • Dimensioning practices for sketches • Components of a computer system that apply to CAD software 	<p>and cavalier) isometric and perspective views</p> <ul style="list-style-type: none"> • Benefits of design using CAD software 	<p>precedence of lines in drafting</p> <ul style="list-style-type: none"> • Complete one and two point perspectives of a house • Show renderings on a pictorial drawing • Complete an isometric from a multi-view drawing • Describe factors that should be included in selecting CAD software • Compare various technical drawings from assorted CAD software
<p>Benchmarks</p> <p><i>Students will be assessed on their ability to:</i></p> <ul style="list-style-type: none"> • Accurately perform orthographic projections to scale. • ADDA Apprentice Drafting Competencies met: Mechanical #5 • Properly select and effectively use different CAD software in various applications 		
<p><i>Academic Connections</i></p>		
<p>ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):</p> <p>RI4.Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text</p>	<p>Sample Performance Task Aligned to the Academic Standard(s):</p> <p>Students will create an orthographic projection drawing from a given part.</p>	

<p>RI7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.</p> <p>G-MG1. Use geometric shapes, their measures, and their properties to describe objects</p>		
<p>Indicator #IDD 5: Implement computer aided software into design work.</p>		
<p>SUB-INDICATOR 5.1 (Webb Level: 1 Identify): Identify CAD skills and applications of technical design.</p>		
<p>SUB-INDICATOR 5.2 (Webb Level: 2 Apply): Apply CAD defaults and preferences to set up a drawing.</p>		
<p>SUB-INDICATOR 5.3 (Webb Level: 4 Generate): Generate drawings and projections using CAD software.</p>		
<p>Knowledge (Factual):</p> <ul style="list-style-type: none"> • Location of toolbars • How to navigate CAD software • Benefits of using files in a CAD system • CAD software operations 	<p>Understand (Conceptual):</p> <ul style="list-style-type: none"> • Efficient workspace • Use of standard templates • Toolbar components • Benefits of using orthographic projections 	<p>Skills (Application):</p> <ul style="list-style-type: none"> • Modify the workspace for individual users • Organize files for easy folder navigation • Modify user specific toolbars • Set up grids and coordinates for assigned project • Create drawing using existing templates in a CAD program • Create and use new custom templates in a CAD program • Produce a drawing of simple two-dimensional object with proper annotations, dimensions and titles

		<ul style="list-style-type: none"> • Produces an orthographic projection to scale of a three-dimensional object with proper annotates, dimensions, and titles
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Benchmarks

Students will be assessed on their ability to:

- Demonstrate efficiency in using CAD software
- Accurately produce a set of professional drawings and models using CAD software

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):

RI4. Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text

RI7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

G-MG1 - Use geometric shapes, their measures, and their properties to describe objects

Sample Performance Task Aligned to the Academic Standard(s):

Using CAD, students will generate a drawing from a given part.

Indicator #IDD 6: Explore career-ready practices.

SUB-INDICATOR 6.1 (Webb Level: 1 Understand): Understand professional drafting practices in the workplace and communication skills.

SUB-INDICATOR 6.2 (Webb Level: 2 Compare): Compare career possibilities in the drafting industry.

Knowledge (Factual):	Understand (Conceptual):	Skills (Application):
<ul style="list-style-type: none"> • ADDA Code of Ethics • Individual job descriptions • Individual responsibilities • Drafting certifications • Postsecondary education degrees 	<ul style="list-style-type: none"> • Dress Code (personal appearance) • Importance of co-worker communications • Acceptable communications • Qualifications necessary for positions • Levels of degrees or qualifications required for drafting positions • Postsecondary options • How to locate available jobs 	<ul style="list-style-type: none"> • Identify supporting positions and their responsibilities • Identify chain of command • Identify responsibilities by position • Demonstrate effective communication skills with others • Identify the components of a resume and employment portfolio • Define future occupations • Research optional schools and qualifications

Benchmarks

Students will be assessed on their ability to:

- Demonstrate proper use of communication skills in a professional working environment and in developing professional relationships
- Accurately demonstrate knowledge of the various drafting practices and how they relate to the field of drafting
- ADDA Apprentice Drafting Competencies met: Architecture #1 Knowing the positions available in a drafting firm and the expectations of those positions will help you prepare for a successful career
- Report on various positions available in a drafting firm and the expectations of those positions

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):

Sample Performance Task Aligned to the Academic Standard(s):

Students will explain orally or in writing various careers in the drafting and design industry.

RI1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

RI4. Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text

RI7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

W2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (

W6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

W8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citati

W9. Draw evidence from informational texts to support analysis, reflection, and research.

SL2. Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data

SL4. Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that

<p>listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range or formal and informal tasks</p>	
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Additional Resources

Please list any resources (e.g., websites, teaching guides, etc.) that would help teachers as they plan to teach these new standards.

Vocabulary

IDD1.1 Recognize basic drafting terms and abbreviations.

1. **Actual Size** - The size of the part as measured
2. **Border Lines** – The heaviest lines used in drafting, serving as a “frame” for a drawing and establishing a space between the drawing and the edge of the paper.
3. **Construction Lines** – Very light lines used as guides for positioning objects on drawings.
4. **Cutting Plane Line** - Graphic Representation: Thick (0.6mm) line that may be used in three different forms; a series of evenly spaced dashes, alternate long dashes and pairs of short dashes, the third would be the same as the previous examples with the dashes between the end lines left out. Description: Used to indicate the location of the cutting plane for section views, line of sight utilizing arrows, and identifies the section through the use of letters. The letters I,O,Q,S,X, and Z are not used.
5. **Cylinder** – A geometric figure with a uniform circular cross-section through its entire length.
6. **Dimension Lines** – Thin lines normally drawn between two extension lines, with arrows or ticks at the ends and a dimension at the center.
7. **Extension Lines** – Light lines used to project dimension lines to specific points on an object.
8. **Gauge (GA)** – any device or instrument for measuring, registering measurements, or testing something, especially for measuring a dimension, quantity, or mechanical accuracy.
9. **Hidden Lines** – Thin, dashed lines used to identify features that cannot be seen in a given view.
10. **Inside diameter (ID)** - The interior surface of a cylindrical part or hole.

11. **Isometric Angel** (common angle & used angles) – A 30° angle used in isometric views off of vertical lines to show width, depth, and height.
12. **Nominal (NOM)** – Size used for purposes of general identification; the actual size of a part will be approximately the same as the nominal size but need not be exactly the same; for example, a rod may be referred to as ¼ inch, although the actual dimension on the drawing is 0.2495 inch, and in thi8s case ¼ inch is the nominal size.
13. **On center (OC)** - A measurement term meaning a certain distance between like materials
14. **Orthographic** – A method of showing a three-dimensional object in two dimension by displaying various views
15. **Outside Diameter (OD)** – The exterior surface of a cylindrical part
16. **Pipe** – a hollow cylinder of metal, wood, or other material, used for the conveyance of water, gas, steam, etc.
17. **Section Lines** – Thin lines used when drawing inside features of an abject exposed by a cutting plane. Lines are drawn using patterns corresponding to different materials.
18. **Tolerance** – An allowable variance from the original dimension.
19. **Tube** – a hollow usually cylindrical body of metal, glass, rubber, or other material, used especially for conveying or containing liquids or gases.
20. **Unidirectional Dimensioning**– A method of dimension in which dimension are placed horizontally on the drawing sheet and read from the bottom of the drawing.

IDD1.2 Differentiate basic drafting tools and their uses.

1. Bevel scales – The four-bevel and two-bevel drafting scales. These architect scales and engineer scales are used to scale and read architectural and engineering drawings. The convenient size of the architectural rulers and engineering rulers make them perfect for the field. Their design makes it easy to place in a pocket. The four bevel scale has four scales on its face, while the two bevel scale only has two scales on its face.
2. **CAD** – Computer aided design
3. **Compass** – A drafting instrument used to draw circles and arcs
4. **Curve** (French & flexible) - a template used for drawing curved lines.
5. **Dividers** – A drafting instrument used to divide and transfer measurements
6. **Drafting Machine** – A device that combines the function of the T-square and triangles, used to draw straight and inclined lines.
7. Inking Pen – An inking pen is a specialize instrument used by an engineer, architect, or drafter to make lines of constant width for architecture, engineering, or technical drawings.
8. **Input Devices** - a device that can be used to insert data into a computer or other computational device
9. **Lead Holder** – A type of drafting pencil, used with different grades of 2 mm lead.
10. **Media Types** - (Bond, Mylar, Vellum, Sepia, and Graph Paper)
 - a. Bond: This is similar to paper we use every day in our office printers. It's the least expensive paper and is usually supplied in a roll form for drafting plotters. Bond is available in different weights. 18 to 24 lb. bond is most commonly used, but much heavier weights can be used for posters and presentation work.
 - b. Mylar: This is a drafting film made from plastic material. It has the advantage of being erasable which, if you are working in ink, is a great advantage. It's also semi-transparent, making it possible to overlay mylar drawings on a light table to check if line work matches up. The film is more resistant to tears and is more durable than paper. It is still used with drafting plotters and is available in roll form and in cut sheets. Mylar has a shiny side and a "matte" side which you draw on. The surface of mylar is quite slippery, and in the past special pens and inks were developed specifically for drawing on it. Modern plotters may have problems printing on mylar because the mylar does not absorb ink quickly like bond paper does. The ink stays wet and may smudge. Mylar is also quite expensive.
 - c. Vellum: This is a linen based paper that has traditionally been used in drafting offices. The high linen content makes it durable and allows

- pencil work to be erased and revised multiple times. It's not as strong as mylar but also is not as expensive. Vellum also has a smooth surface which does not absorb ink as fast as bond paper. That may cause problems in plotters with smudging.
- d. **Sepia:** A dark brown ink or pigment originally prepared from the secretion of the cuttlefish.
 - e. **Graph paper:** Paper ruled usually into small squares of equal size for use in drawing charts, graphs, or diagrams.
11. **Mouse** – A computer input device that allows the user to move the on-screen cursor quickly and easily.
 12. **Protractor** – A drafting tool with degree graduations, used to measure and lay out angles
 13. **Scales** (architect, metric, engineers) – a measuring device used to convert full-size dimensions to the drawing scale. Different types of scales include the architect's scale, engineer's scale, mechanical drafter's scale, and metric scale. The term scale also refers to the size to which a drawing is made.
 14. **Software** -
 15. **T-square** – A drafting instrument consisting of a head and a blade, used to lay out and draw horizontal lines.
 16. **Template** – in manual drafting, a plastic sheet with openings of different sizes and shapes that can be traced accurately. In CAD drafting, a file with standard user settings used to start a drawing file.
 17. **Triangles** (30-60-90 & 45) – A set square or triangle is an object used in engineering and technical drawing, with the aim of providing a straightedge at a right angle or other particular planar angle to a baseline.

IDD2.1 Apply Algebraic and Trigonometric formulas used in drafting and design.

1. **Arc** – Portion of a circle
2. **Area** – The size of a particular surface
3. **Bisecting an Angle** – to divide an angle into two equal angles.
4. **Centimeters** - a metric unit of length, equal to one hundredth of a meter.
5. **Circumference** – the perimeter of a circle
6. **Common Denominator** – a shared multiple of the denominators of several fractions.
7. **Foreshortened** - Portray or show (an object or view) as closer than it is or as having less depth or distance, as an effect of perspective or the angle of vision.
8. **Hexagon** – a six sided figure with each side forming a 60° angle
9. **Meters** - the fundamental unit of length in the metric system, equal to 100 centimeters or approximately 39.37 inches.

10. **Millimeters** - one thousandth of a meter (0.039 in.).
11. **Oblique** – A pictorial drawing in which the front view of an object is parallel to the projection plane and shown in its true size and shape.
12. **Pentagon** – A five sided geometric figure with each side forming a 72° angle.
13. **Perimeter** – the continuous line forming the boundary of a closed geometric figure.
14. **Quadrilateral** – a four sided figure
15. Rectified Length -
16. **Skew** - neither parallel nor intersecting.
17. **Trapezoid** – a quadrilateral with only one pair of parallel sides.
18. True Angle –

IDD2.2 Understand the various drawing scales used in drafting.

1. **Architect Scale** – a specialized ruler designed to facilitate the drafting and measuring of architectural drawings, such as floor plans and orthographic projections
2. **Decimal Engineers Scale** – When drawings are created some typical scales are; $\frac{1}{4}$, $\frac{1}{2}$, Full (1:1) for mechanical drawings. For example a $\frac{1}{4}$ scale drawing means the object is drawn a quarter inch its actual size on the sheet.
3. **Fraction** – a numerical quantity that is not a whole number
4. **Imperial** – The system of imperial units or the imperial system (also known as British Imperial) is the system of units first defined in the British Weights and Measures Act of 1824, which was later refined and reduced. The system came into official use across the British Empire. By the late 20th century, most nations of the former empire had officially adopted the metric system as their main system of measurement; however some Imperial units are still used in the United Kingdom and Canada.
5. **Mechanical Scale** – Mechanical engineer scales are inch graduated, with common drawing scales on each face. These are used to make drawings of mechanical parts.
6. **Metric** – of or based on the meter as a unit of length; relating to the metric system.
7. **Metric Scale** – The difference with metric scales is that they are in the metric system instead of inches.

IDD3.1 Integrate shapes, lettering and Geometric symbology used on technical drawings.

1. **Acute triangle** - a triangle whose interior angles are all acute (angle less than 90°)
2. ANSI Y14.2M,
3. **Apex** – the top or highest part of something.
4. **Arc** – portion of a circle.
5. **Cone** - a solid or hollow object that tapers from a circular or roughly circular base to a point.
6. **Cube** - a symmetrical three-dimensional shape, either solid or hollow, contained by six equal squares.
7. **Cylinder** – a geometric figure with a uniform circular cross-section through its entire length.
8. **Ellipse** – a closed curve in the form of a symmetrical oval.
9. **Equilateral Triangle** – a three-sided regular polygon.
10. **Gothic** – Engineering drawings use a Gothic sans-serif script, formed by a series of short strokes.
11. **Hexagon** – a six sided figure with each side forming a 60° angle
12. **Isosceles Triangle** – a triangle with two equal sides.
13. Lettering – Technical lettering is the process of forming letters, numerals, and other characters in technical drawing. It is used to describe or provide detailed specifications for an object. With the goals of legibility and uniformity styles are standardized and lettering ability has little relationship to normal writing ability.
14. **Obtuse Triangle** – a triangle that contains an obtuse interior angle.
15. **Octagon** – an eight-sided geometric figure with each side forming a 45° angle.
16. **Pentagon** – A five sided geometric figure with each side forming a 72° angle.
17. **Prism** - a solid geometric figure whose two end faces are similar, equal, and parallel rectilinear figures, and whose sides are parallelograms.
18. **Rectangle** – a geometric figure with opposite sides equal in length and each corner forming a 90° angle.

19. **Rhombus** - a parallelogram with opposite equal acute angles, opposite equal obtuse angles, and four equal sides.
20. **Right Triangle** - a triangle with a right angle.
21. **Single Stroke** – Any letter that can be formed using a single stroke, as in the letters “I”, “J”, “U”, “S”, etc.
22. **Square** - a plane figure with four equal straight sides and four right angles.
23. tangent vertex,
24. **Wedge** – an object with at least one slanting side ending in a sharp edge, which cuts material apart.

IDD3.2 Illustrate line symbols recommended by American National Standard Institute (ANSI).

1. **Border Lines** – The heaviest lines used in drafting, serving as a “frame” for a drawing and establishing a space between the drawing and the edge of the paper.
2. **Center Lines** – Thin lines made up of long and short dashes with spaces in between used to indicate centers of symmetrical objects.
3. **Construction lines** – Very light lines used as guides for positioning objects on drawings.
4. **Cutting-plane Lines** - Graphic Representation: Thick (0.6mm) line that may be used in three different forms; a series of evenly spaced dashes, alternate long dashes and pairs of short dashes, the third would be the same as the previous examples with the dashes between the end lines left out. Description: Used to indicate the location of the cutting plane for section views, line of sight utilizing arrows, and identifies the section through the use of letters. The letters I,O,Q,S,X, and Z are not used
5. **Dimension Lines** - Thin lines normally drawn between two extension lines, with arrows or ticks at the ends and a dimension at the center.
6. **Hidden Lines** - Thin, dashed lines used to identify features that cannot be seen in a given view.
7. **Object Lines** - Thick lines drawn to indicate the visible edges and intersection of an object
8. **Phantom Lines** – Thin lines made up of long and short dashes, used to indicate alternate positions for moving parts, repeated details, or motion paths.
9. **Section Lines** – thin lines used when drawing inside features of an object exposed by a cutting plane. Lines are drawn using patterns corresponding to different materials.

IDD3.3 Define dimensioning styles and techniques on metric and imperial drawings.

1. **Counter bore** – a deep recess at the end of a smaller hole used to provide a bearing surface for the head of a bolt or nut.
2. **Diameter** – the distance from one side of a circle to the other, running directly through the circle’s center.
3. **Dimensioning** – lettering or text on a drawing defining object sizes and locations.
4. **General Notes** – apply generally to the contents of the drawing, as opposed to applying only to certain part numbers or certain surfaces or features.
5. **Hole** - a hollow place in a solid body or surface.

6. **Imperial** - The system of imperial units or the imperial system (also known as British Imperial) is the system of units first defined in the British Weights and Measures Act of 1824, which was later refined and reduced. The system came into official use across the British Empire. By the late 20th century, most nations of the former empire had officially adopted the metric system as their main system of measurement; however some Imperial units are still used in the United Kingdom and Canada.
 7. **Isometric** – a pictorial drawing in which two horizontal axes at 30° to horizontal and a vertical axis are used to show an object’s width, depth, and height.
 8. **Leader** – an angular dimension line used to point out special characteristics of objects.
 9. local notes,
 10. **Metric** - of or based on the meter as a unit of length; relating to the metric system.
 11. **Ordinate** - the *y* -coordinate, representing the distance from a point to the horizontal or *x* -axis measured parallel to the vertical or *y* -axis.
 12. **Orthographic** – a method of showing a three-dimensional object in two dimensions by displaying various views.
 13. **Radius** – the distance from any point on a circle to the circle’s center.
- Rectangular C

1. **1st angle projection** – typically used in most European countries
2. **3rd angle projection** – preferred in the United States
3. **Elliptical** – A curved line forming a closed loop where the sum of the distances from two points (foci) to every point on the line is constant.
4. **Foreshortened** – a surface that is drawn smaller than its true shape and size
5. **Glass box** - you place an object in a glass box so that the sides of the box are parallel to the major surfaces of the object, you can project the surfaces of the object onto the sides of the glass box and create multi views.
6. **Projection plane** – the plane on which the surface is projected (top, front, r. side)
7. **Projection planes (horizontal, frontal, & profile)** – the projection of the features of the object is made by lines of sight that are perpendicular to the plane of projection. **elliptical**
8. **True shape** – an object that is drawn to its actual shape and size

IDD4.2 Create isometric and pictorial drawings.

1. **Isometric** – a representation of an object in which two horizontal axes drawn at 30° to horizontal and a vertical axis are used to show the object’s width, depth, and height
2. **Multi-view drawing** – a multi-view drawing refers to a drawing that has the top view, side view, and front view of the particular object it is representing. It also comprises of the isometric projection of that object.
3. **One & two point perspective** – one point perspective has lines that converge to a single vanishing point, and two point perspective has lines that converge to two vanishing points.
4. **Pictorial drawing** – a single view drawing showing an object in three dimensions as it appears to the human eye.

IDD5.1 Identify CAD skills and applications of technical design.

1. **Copiers** - a machine that makes exact copies of something, esp. documents, video or audio recordings, or software
2. **Digitizing pad** - A graphics tablet or digitizer is a computer input device that enables a user to hand-draw images, animations and graphics, similar to the way a person draws images with a pencil and paper.
3. **Hard drive** - a high-capacity, self-contained storage device containing a read-write mechanism plus one or more hard disks, inside a sealed unit
4. **Keyboard** - a panel of keys that operate a computer
5. **Memory** - a device (as a chip) or a component of a device in which information especially for a computer can be inserted and stored and from which it may be extracted when wanted
6. **Mouse** – a computer input device that allows the user to move the on-screen cursor quickly and easily
7. **Plotter** – a computer program or device that creates a graph or chart from information
8. **Printer** - a machine for printing text or pictures onto paper, esp. one linked to a computer
9. **Processor** - a computer program (as a compiler) that puts another program into a form acceptable to the computer
10. **Storage (CD & DVD)** - the retention of retrievable data on a computer or other electronic system; memory

IDD5.2 Apply CAD defaults and preferences to set up a drawing.

1. **Coordinates** – the positions or locations of points on the X, Y, and Z planes. In a CAD system, the points represent units of real measurement from a fixed point.

2. Files -
3. folder navigation
4. **Grids** – is a network of uniformly spaced points used to determine distances.
5. **Templates** – a special blank page that controls the layout of the page
6. **Toolbars** – a on-screen buttons, icons, menus, or other input or output elements are placed
7. Workspace – an area provide for one to work.

IDD5.3 Apply CAD software in technical design.

1. **3-D modeling** – 3D based drawing in which changes to object parameters during the modeling process affect the entire model.
2. **Orthographic projections** – a method of showing a three-dimensional object in two dimensions by displaying various views

IDD6.1 Understand professional drafting practices in the workplace and communication skills.

1. **Chain of command** - a series of executive positions in order of authority
2. **Supporting organizations (AIA, IBCC, ADDA, ANSI, sub-contracting firms)**
 - a. AIA: American Institute of Architects.
 - b. IBCC: The Inter Board Committee of Chairman was established in 1972 under a resolution of the Ministry of Education with a view to exchange information among member Boards, coordinate activities of the Boards, achieve fair measure of uniformity of academic, evaluation and curricular standards to promote curricular and co-curricular activities on Inter Board basis.
 - c. ADDA: American Design Drafting Association provides industry based tests and drafting certifications.
 - d. ANSI: American National Standards Institute, oversees the creation, promulgation and use of thousands of norms and guidelines that directly impact businesses in nearly every sector. ANSI is also actively engaged in accrediting programs that assess conformance to standards.

IDD6.2 Compare career possibilities in the drafting industry.

1. **Cover letter** - a letter sent with, and explaining the contents of, another document or a parcel of goods.
2. **Portfolio** – a set of drawings, painting, or photographs that are presented together in a folder.
3. **Resume** - A brief account of one's professional or work experience and qualifications, often submitted with an employment application.

4. **Social Skills** - is any skill facilitating interaction and communication with others
5. **South Dakota MyLife** – career exploration software.
6. **Work traits** – a distinguishing feature of a person’s work ethic.