Name:

# 12'o Quad High APA Research Rubric for Mathematics and Drafting

| | 4 | 6 | 8 | 10 | Pts |
|---|---|---|---|---|---|
| Organization (Math) | •Cannot be understood<br>•Because of lack of sequence. There is no introduction or conclusion. | •Lacks logical sequence of presentation<br>•Only an introduction or conclusion | •Information in logical sequence which audience can follow.<br>•There is an introduction and conclusion to the organization. | •Logical, interesting sequence which audience can follow.<br>•There is an introduction (central purpose or idea) and conclusion (summary of main and subtopics) to the organization and it conveys the essence of the problem. | |
| Knowledge (Math) | Demonstrates no knowledge and preparedness when answering questions about structural design and use and errors are present<br>•Little explanation Newton's Laws, and Bernoulli's Principles<br>•Uses no geometric shapes and gives no explanation<br>•Elaborations on some of the questions formulated before research.<br>•Uses no vocabulary<br>•Does not discusses the use of drones for security and disaster without examples<br>•No understanding the physics of flight | Demonstrates incomplete knowledge and preparedness when answering questions about structural design and use and errors are present<br>•Incomplete explanation Newton's Laws, and no explanation of Bernoulli's Principles<br>•Uses geometric shapes and gives no explanation of their purpose.<br>•Elaborations on some of the questions formulated before research.<br>•Uses vocabulary incorrectly<br>•Does not discusses the use of drones for security and disaster without examples<br>•Incomplete understanding the physics of flight | Demonstrates incomplete knowledge and preparedness when answering questions about structural design and use<br>•Incomplete explanation Newton's Laws and Bernoulli's Principles<br>•Uses geometric shapes and gives an explanation of their purpose.<br>•Elaborations on questions formulated before research.<br>•Uses most vocabulary correctly<br>•Discusses the use of drones for security and disaster without examples<br>•Incomplete understanding the physics of flight | •Demonstrates full knowledge and preparedness (more than required) by answering questions about structural design and use<br>•Clearly explains Newton's Laws, and Bernoulli's Principles<br>•Uses geometric shapes with and gives an explanation of their purpose.<br>•Elaborations on questions formulated before research.<br>•Uses vocabulary correctly<br>•Discusses the use of drones for security and disaster with examples<br>•Understands the physics of flight | |
| Design (Drafting) | •Incomplete exploded assembly drawings are flawed or missing.<br>•Multi-copter exploded assembly is flawed, unlabeled or missing.<br>•Drawing view orientation is unclear and significantly flawed.<br>•List of used/required parts (bill of material) is not included.<br>•Final design drawings of some "printed" parts are missing.<br>•Multi-view drawings showing final design of student-commissioned (non-"printed") components are incorrect or missing.<br>•Multi-view drawings are not dimensioned or missing. | •Exploded assembly drawings of the team multi-copter include significant errors.<br>•Multi-copter exploded assembly drawing is labeled with significant errors or omissions.<br>•Drawing orientation provides unclear view of multi-copter design and assembly.<br>•List of used/required parts (bill of material) is not in table format or missing major components.<br>•Final design of several "printed" parts is not shown in multi-view, isometric | •Incomplete exploded assembly drawings of the team multi-copter are included.<br>•Multi-copter exploded assembly drawing is fully labeled with minor errors.<br>•Drawing orientation provides partial obstructed view of multi-copter design and assembly.<br>•Mostly complete list of used/required parts (bill of material) is included in table format.<br>•Final design of one or more each "printed" part is not shown in multi-view, isometric assembly, and 3-D drawings. | •Complete exploded assembly drawings of the team multi-copter are included.<br>•Multi-copter exploded assembly drawing is fully and properly labeled.<br>•Drawing orientation provides clear view of multi-copter design and assembly.<br>•Complete list of used/required parts (bill of material) is included in table format.<br>•Final design of each "printed" part is shown in multi-view, isometric assembly, and 3-D drawings.<br>•Final design of each student-commissioned (non-"printed") component is shown in multi-view drawings with complete dimensions. | |

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| | | assembly, and 3-D drawing formats.<br>•Multi-view drawings showing final design of student-commissioned (non-"printed") components contain significant errors or missing dimensions.<br>•Multi-view drawings are not completely dimensioned. | •Multi-view drawings showing final design of student-commissioned (non-"printed") components include minor errors.<br>•Most multi-view drawings are completely and properly dimensioned. | •ALL multi-view drawings are completely and properly dimensioned. | |
| Use of Technical Illustration (Drafting) | •Uses no more than one (1) appropriate technical illustration to show examples and understanding of the science and math behind flight and multi-copter design.<br>•Technical illustrations are not labeled and captioned.<br>•Technical illustrations irrelevant or not included.<br>•No technical illustration listing is included at the end of the research paper. | •Uses only two or three (2-3) appropriate technical illustrations to show examples and understanding of the science and math behind flight and multi-copter design.<br>•Technical illustrations are labeled and captioned but not properly and clearly<br>•Technical illustrations included but not located with related text or do not relate to text in research paper.<br>•Not all technical illustrations are listed in an Illustration Index at the end of the research paper or index contains significant errors. | •Uses four (4) appropriate technical illustrations to show examples and understanding of the science and math behind flight and multi-copter design.<br>•Most technical illustrations are properly and clearly labeled and captioned.<br>•Technical illustrations are near related text but not sized and positioned for ease of reference while reading.<br>•ALL technical illustrations are listed in an Illustration Index at the end of the research paper (with minor errors). | •Uses at least five (5) appropriate technical illustrations to show examples and understanding of the science and math behind flight and multi-copter design.<br>•Technical illustrations are properly and clearly labeled and captioned.<br>•Technical illustrations are sized and positioned for ease of reference while reading related text.<br>•ALL technical illustrations are listed in an Illustration Index at the end of the research paper. | |
| Model/Mock-up (Math/ Drafting) | •No model of final design is created.<br>•No picture or drawing of the model/mock-up is included. | •A model is created but does not show final design concept.<br>•A picture or drawing of the model/mock-up is included without appropriate scale. | •A non-detailed model of final design is created to show final design concept.<br>•A picture or drawing of the model/mock-up is included with inappropriate scale. | •A detailed model of final design is created to show final design concept.<br>•A picture or drawing of the model/mock-up is included with appropriate scale. | |
| Work & Calculation (Math) | •Lack of mathematical understanding with no example<br>•No display of calculations<br>•Incorrect use of mathematical format and calculations are incorrect<br>•Does not use formulas | •Limited mathematical understanding with at least 1 example<br>•Incomplete display of calculations with minor errors<br>•Incomplete use of mathematical format and calculations are incorrect<br>•Does not use formulas | • Accurate mathematical with at least 2 examples<br>•Incomplete display of calculations<br>•Incomplete use of mathematical format and calculations are not informative<br>•ineffective use of formulas | •Complete and accurate mathematical understanding with at least 3 examples<br>•Clear display of calculations<br>•Creative use of mathematical format and calculations are informative<br>•Effective use of formulas | |
| | | | | Total Score | |