



Application Guidelines

Freelance WorkKeys Test Question Writers – Applied Mathematics

Send a current copy of your **resume** and **one sample item** modeled on the one shown in this packet to Robin Stoker at:

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Iowa City, IA 52243-0168

Samples that do not meet the requirements will not be considered.

Submissions should be formatted in the same way as the sample. Each item must include:

- 5 foils or options
- a single key or correct answer
- justifications for each foil
 - if it is incorrect, why it is wrong but still an attractive answer
 - if it is the key, why it is correct but not too obvious
- the level of the stimulus and foils, based on the test characteristics found on the next two pages, and why you feel it is at that level

Some general points to keep in mind are:

1. Items must be work-related, using math that someone would actually use on the job. They should not be from the point of view of the consumer.
2. Situations must be realistic and feasible, not contrived. Ask yourself the following questions: Is this something I'd find in the real working world? Would someone actually need to do this on the job?
3. The item should be set up in some way. That is, you might start off an item with "You are a machinist..." or "You develop websites for small businesses..."
4. The situation and the items need to be at the same level of difficulty.

Characteristics/Skills

There are five levels of difficulty. Level 3 is the least complex and Level 7 is the most complex. The levels build on each other, each incorporating the skills assessed at the previous levels. For example, at Level 5, individuals need the skills from Levels 3, 4, and 5. Examples are included with each level description.

Level	Characteristics of Items	Skills
3	<ul style="list-style-type: none">• Translate easily from a word problem to a math equation• All needed information is presented in logical order• No extra information	<ul style="list-style-type: none">• Solve problems that require a single type of mathematics operation (addition, subtraction, multiplication, and division) using whole numbers• Add or subtract negative numbers• Change numbers from one form to another using whole numbers, fractions, decimals, or percentages• Convert simple money and time units (e.g., hours to minutes)

Level	Characteristics of Items	Skills
4	<ul style="list-style-type: none">• Information may be presented out of order• May include extra, unnecessary information• May include a simple chart, diagram, or graph	<ul style="list-style-type: none">• Solve problems that require one or two operations• Multiply negative numbers• Calculate averages, simple ratios, simple proportions, or rates using whole numbers and decimals• Add commonly known fractions, decimals, or percentages (e.g., $\frac{1}{2}$, .75, 25%)• Add up to three fractions that share a common denominator• Multiply a mixed number by a whole number or decimal• Put the information in the right order before performing calculations

Level	Characteristics of Items	Skills
5	<ul style="list-style-type: none">• Problems require several steps of logic and calculation (e.g., problem may involve completing an order form by totaling the order and then computing tax)	<ul style="list-style-type: none">• Decide what information, calculations, or unit conversions to use to solve the problem• Look up a formula and perform single-step conversions within or between systems of measurement• Calculate using mixed units (e.g., 3.5 hours and 4 hours 30 minutes)• Divide negative numbers• Find the best deal using one- and two-step calculations and then comparing results• Calculate perimeters and areas of basic shapes (rectangles and circles)• Calculate percent discounts or markups

Level	Characteristics of Items	Skills
6	<ul style="list-style-type: none"> • May require considerable translation from verbal form to mathematical expression • Generally require considerable setup and involve multiple-step calculations 	<ul style="list-style-type: none"> • Use fractions, negative numbers, ratios, percentages, or mixed numbers • Rearrange a formula before solving a problem • Use two formulas to change from one unit to another within the same system of measurement • Use two formulas to change from one unit in one system of measurement to a unit in another system of measurement • Find mistakes in questions that belong at Levels 3, 4, and 5 • Find the best deal and use the result for another calculation • Find areas of basic shapes when it may be necessary to rearrange the formula, convert units of measurement in the calculations, or use the result in further calculations • Find the volume of rectangular solids • Calculate multiple rates

Level	Characteristics of Items	Skills
7	<ul style="list-style-type: none"> • Content or format may be unusual • Information may be incomplete or implicit • Problems often involve multiple steps of logic and calculation 	<ul style="list-style-type: none"> • Solve problems that include nonlinear functions and/or that involve more than one unknown • Find mistakes in Level 6 questions • Convert between systems of measurement that involve fractions, mixed numbers, decimals, and/or percentages • Calculate multiple areas and volumes of spheres, cylinders, or cones • Set up and manipulate complex ratios or proportions • Find the best deal when there are several choices • Apply basic statistical concepts

Sample of an item set ready for submission.

Level 6
(Your Name)
Date
Confidential

1. The lathe you operate uses carbide inserts. Each insert has 4 cutting edges that are used 1 at a time. Each cutting edge lasts for 14 parts, and the machine runs 36 parts per hour. How many inserts will you need during a 10-hour shift?

- A. 6
- B. 7
- C. 11
- D. 14
- E. 26

Skill/Task assessed: Calculate multiple rates.

Justifications:

A. Incorrect: $36 \times 10 \div (14 \times 4) = 6.4$, rounded to 6 (improperly rounded down; a seventh insert will be needed to complete the shift)

B. **Correct:** $36 \text{ parts/hour} \times 10 \text{ hours} = 360 \text{ parts}$; $360 \text{ parts} \div (14 \text{ parts/edge} \times 4 \text{ edges/insert}) = 360 \text{ parts} \div 56 \text{ parts/insert} = 6.4$, properly rounded up to 7 inserts

Multiply the number of parts/hour by the number of hours/shift to get the number of parts/shift. Divide this by the product of the numbers of parts/edge and edges/insert and round up.

C. Incorrect: $36 \div 14 \times 4 = 10.3$, rounded to 11 (omitted the length of the shift and multiplied instead of dividing by the number of cutting edges/insert)

D. Incorrect: 14 (picked up the number of parts per cutting edge with no calculation)

E. Incorrect: $36 \times 10 \div 14 = 25.7$, rounded to 26 (did not include the number of cutting edges per insert in the calculation)