# Quantitative Math Assessment

Auto-generated MCQs across the curriculum

@title Quantitative Math Assessment  
@description Auto-generated MCQs across the curriculum

@question Consider the following list of numbers: 1, 2, 9, 13, 27. How many of these numbers are prime?  
@instruction Select the correct count of prime numbers from the given list.  
@difficulty easy  
@Order 1  
@option 1  
@@option 2  
@option 3  
@option 4  
@explanation  
A prime number is a natural number greater than 1 that has no positive divisors other than 1 and itself. Let's analyze each number:  
- 1 is neither prime nor composite.  
- 2 is a prime number (divisors: 1, 2).  
- 9 is a composite number (divisors: 1, 3, 9).  
- 13 is a prime number (divisors: 1, 13).  
- 27 is a composite number (divisors: 1, 3, 9, 27).  
Therefore, there are 2 prime numbers (2 and 13) in the given list.  
@subject Quantitative Math  
@unit Numbers and Operations  
@topic Prime & Composite Numbers  
@plusmarks 1

@question What is the sum of all prime numbers between 20 and 30 (exclusive)?  
@instruction Select the correct sum.  
@difficulty moderate  
@Order 2  
@option 48  
@option 50  
@@option 52  
@option 54  
@explanation  
A prime number is a natural number greater than 1 that has no positive divisors other than 1 and itself. The numbers between 20 and 30 are 21, 22, 23, 24, 25, 26, 27, 28, 29. Among these, only 23 and 29 are prime numbers. Their sum is $23 + 29 = 52$.  
@subject Quantitative Math  
@unit Numbers and Operations  
@topic Basic Number Theory  
@plusmarks 1

@question A small business sells handmade bracelets and necklaces. Let $B$ represent the number of bracelets sold in a day and $N$ represent the number of necklaces sold in a day. If each bracelet costs $15 and each necklace costs $25, what does the expression $15B + 25N$ represent?  
@instruction Select the best interpretation of the given algebraic expression.  
@difficulty easy  
@Order 3  
@option The total number of bracelets and necklaces sold.  
@option The total cost of making one bracelet and one necklace.  
@@option The total revenue from selling bracelets and necklaces.  
@option The profit from selling bracelets and necklaces.  
@explanation  
The term $15B$ represents the total revenue generated from selling $B$ bracelets, since each bracelet sells for $15. Similarly, $25N$ represents the total revenue from selling $N$ necklaces at $25 each. Therefore, the sum $15B + 25N$ represents the total revenue from selling both bracelets and necklaces.  
@subject Quantitative Math  
@unit Algebra  
@topic Interpreting Variables  
@plusmarks 1

@question Simplify the expression: $(2a^{-4}b^3)(3a^2b^{-5})$  
@instruction Choose the correct simplified form.  
@difficulty moderate  
@Order 4  
@option $6a^{-2}b^{-2}$  
@option $6a^2b^2$  
@@option $\frac{6}{a^2b^2}$  
@option $\frac{5}{a^2b^2}$  
@explanation  
To simplify the expression, first multiply the numerical coefficients: $2 \times 3 = 6$. Next, apply the product rule for exponents ($x^m \cdot x^n = x^{m+n}$) to each variable. For variable 'a': $a^{-4} \cdot a^2 = a^{-4+2} = a^{-2}$. For variable 'b': $b^3 \cdot b^{-5} = b^{3-5} = b^{-2}$. Combining these, we get $6a^{-2}b^{-2}$. Finally, convert the terms with negative exponents to positive exponents by moving them to the denominator: $6a^{-2}b^{-2} = 6 \cdot \frac{1}{a^2} \cdot \frac{1}{b^2} = \frac{6}{a^2b^2}$.  
@subject Quantitative Math  
@unit Algebra  
@topic Exponential Expressions (Product rule, negative exponents)  
@plusmarks 1

@question A mother is currently four times as old as her daughter. In 6 years, the mother will be three times as old as her daughter. What is the daughter's current age?  
@instruction Select the correct option.  
@difficulty moderate  
@Order 5  
@option 8 years old  
@option 10 years old  
@@option 12 years old  
@option 14 years old  
@explanation  
Let $D$ be the daughter's current age and $M$ be the mother's current age.  
From the first statement, "A mother is currently four times as old as her daughter":  
$M = 4D$ (Equation 1) From the second statement, "In 6 years, the mother will be three times as old as her daughter":  
In 6 years, the mother's age will be $M+6$ and the daughter's age will be $D+6$.  
So, $M+6 = 3(D+6)$ (Equation 2) Substitute Equation 1 into Equation 2:  
$4D + 6 = 3(D+6)$  
$4D + 6 = 3D + 18$  
Subtract $3D$ from both sides:  
$D + 6 = 18$  
Subtract $6$ from both sides:  
$D = 12$ So, the daughter's current age is 12 years old.  
@subject Quantitative Math  
@unit Problem Solving  
@topic Algebra  
@plusmarks 1

@question Which of the following statements accurately describes a property of rational numbers?  
@instruction Select the correct statement.  
@difficulty moderate  
@Order 6  
@option The product of any two rational numbers is always an integer.  
@option Every irrational number can be expressed as a terminating or repeating decimal.  
@option The sum of a rational number and an irrational number is always a rational number.  
@@option Every integer is a rational number.  
@explanation  
A rational number is any number that can be expressed as the quotient or fraction $p/q$ of two integers, a numerator $p$ and a non-zero denominator $q$. Every integer $n$ can be written as $n/1$, where both $n$ and $1$ are integers and $1 \neq 0$. Therefore, every integer is a rational number. The other statements are incorrect: the product of two rational numbers is not always an integer (e.g., $(1/2) \times (1/3) = 1/6$); irrational numbers have non-terminating, non-repeating decimal expansions; and the sum of a rational and an irrational number is always irrational.  
@subject Quantitative Math  
@unit Numbers and Operations  
@topic Rational Numbers  
@plusmarks 1

@question Consider the data set: $\{7, 9, 10, 12, 15, 17\}$. What is the absolute difference between the median and the mean of this data set?  
@instruction Calculate the mean and median of the given data set, then find the absolute difference between them.  
@difficulty moderate  
@Order 7  
@option $1/3$  
@@option $2/3$  
@option $1$  
@option $1.5$  
@explanation  
First, calculate the mean. The sum of the data points is $7+9+10+12+15+17 = 70$. There are 6 data points, so the mean is $70/6 = 35/3 \approx 11.67$.<br>Next, calculate the median. Since the data set is already sorted and has an even number of data points (6), the median is the average of the two middle terms. The middle terms are 10 and 12. So, the median is $(10+12)/2 = 22/2 = 11$.<br>Finally, find the absolute difference between the median and the mean: $|11 - 35/3| = |33/3 - 35/3| = |-2/3| = 2/3$.  
@subject Quantitative Math  
@unit Data Analysis & Probability  
@topic Mean, Median, Mode, & Range  
@plusmarks 1

@question Given the functions $f(x) = 3x - 2$ and $g(x) = x^2 + 5$. Determine the expression for $(f \circ g)(x)$.  
@instruction Select the correct composition of functions.  
@difficulty moderate  
@Order 8  
@@option $3x^2 + 13$  
@option $9x^2 - 12x + 9$  
@option $3x^3 - 2x^2 + 15x - 10$  
@option $x^2 + 3x + 3$  
@explanation  
To find $(f \circ g)(x)$, we substitute $g(x)$ into $f(x)$. So, $(f \circ g)(x) = f(g(x)) = f(x^2 + 5)$. Replacing $x$ in $f(x)$ with $(x^2 + 5)$, we get $3(x^2 + 5) - 2 = 3x^2 + 15 - 2 = 3x^2 + 13$.  
@subject Quantitative Math  
@unit Algebra  
@topic Functions Operations  
@plusmarks 1

@question A coffee shop sells two types of coffee beans: Arabica and Robusta. Arabica beans cost \$12 per pound, and Robusta beans cost \$8 per pound. If a customer buys a total of 5 pounds of coffee for a total cost of \$52, how many pounds of Arabica beans did the customer buy?  
@instruction Select the correct number of pounds of Arabica beans.  
@difficulty moderate  
@Order 9  
@option 2 pounds  
@@option 3 pounds  
@option 4 pounds  
@option 5 pounds  
@explanation  
Let 'a' be the pounds of Arabica beans and 'r' be the pounds of Robusta beans. We have two equations based on the given information: \(a + r = 5\) (total pounds) and \(12a + 8r = 52\) (total cost). From the first equation, we can express \(r\) as \(r = 5 - a\). Substitute this into the second equation: \(12a + 8(5 - a) = 52\). This simplifies to \(12a + 40 - 8a = 52\), which further simplifies to \(4a + 40 = 52\). Subtracting 40 from both sides gives \(4a = 12\). Dividing by 4, we find \(a = 3\). Therefore, the customer bought 3 pounds of Arabica beans.  
@subject Quantitative Math  
@unit Algebra  
@topic Algebraic Word Problems  
@plusmarks 1

@question In an arithmetic sequence, the 3rd term is 15 and the 7th term is 35. What is the 10th term of the sequence?  
@instruction Select the correct value for the 10th term of the arithmetic sequence.  
@difficulty moderate  
@Order 10  
@option 45  
@@option 50  
@option 55  
@option 60  
@explanation  
Let the first term be $a\_1$ and the common difference be $d$. \nGiven $a\_3 = 15$ and $a\_7 = 35$. \nUsing the formula for the $n$-th term of an arithmetic sequence, $a\_n = a\_1 + (n-1)d$: \n$a\_3 = a\_1 + (3-1)d \implies a\_1 + 2d = 15$ (Equation 1) \n$a\_7 = a\_1 + (7-1)d \implies a\_1 + 6d = 35$ (Equation 2) \nSubtract Equation 1 from Equation 2: \n$(a\_1 + 6d) - (a\_1 + 2d) = 35 - 15$ \n$4d = 20$ \n$d = 5$ \nSubstitute $d=5$ into Equation 1: \n$a\_1 + 2(5) = 15$ \n$a\_1 + 10 = 15$ \n$a\_1 = 5$ \nNow, find the 10th term, $a\_{10}$: \n$a\_{10} = a\_1 + (10-1)d$ \n$a\_{10} = 5 + 9(5)$ \n$a\_{10} = 5 + 45$ \n$a\_{10} = 50$  
@subject Quantitative Math  
@unit Numbers and Operations  
@topic Sequences & Series  
@plusmarks 1

@question A small library recorded the number of books borrowed in two categories, Fiction and Non-Fiction, over three consecutive weeks. The borrowing data is as follows: \* \*\*Week 1:\*\* Fiction: 120 books, Non-Fiction: 80 books  
\* \*\*Week 2:\*\* Fiction: 130 books, Non-Fiction: 90 books  
\* \*\*Week 3:\*\* Fiction: 110 books, Non-Fiction: 100 books Based on this data, what was the total number of Non-Fiction books borrowed over the three weeks, and what was the average number of Fiction books borrowed per week?  
@instruction Based on the provided data, answer the question.  
@difficulty moderate  
@Order 11  
@@option Total Non-Fiction: 270 books, Average Fiction: 120 books  
@option Total Non-Fiction: 270 books, Average Fiction: 110 books  
@option Total Non-Fiction: 260 books, Average Fiction: 120 books  
@option Total Non-Fiction: 260 books, Average Fiction: 110 books  
@explanation  
To find the total number of Non-Fiction books, sum the Non-Fiction borrowings for each week: $80 + 90 + 100 = 270$ books. To find the average number of Fiction books borrowed per week, sum the Fiction borrowings for each week and divide by the number of weeks: $(120 + 130 + 110) / 3 = 360 / 3 = 120$ books.  
@subject Quantitative Math  
@unit Data Analysis & Probability  
@topic Interpretation of Tables & Graphs  
@plusmarks 1

@question What is the best estimate for the product of 47 and 23, if each number is first rounded to the nearest ten?  
@instruction Select the best estimate.  
@difficulty easy  
@Order 12  
@option 800  
@option 900  
@@option 1000  
@option 1200  
@explanation  
To estimate the product, first round each number to the nearest ten. 47 rounds to 50. 23 rounds to 20. Then, multiply the rounded numbers: $50 \times 20 = 1000$.  
@subject Quantitative Math  
@unit Numbers and Operations  
@topic Estimation  
@plusmarks 1

@question What is the value of the expression $-8 \times (-4) + 12 \div (-3)$?  
@instruction Calculate the value of the given expression.  
@difficulty moderate  
@Order 13  
@@option 28  
@option -28  
@option 36  
@option -36  
@explanation  
First, perform the multiplication: $-8 \times (-4) = 32$ (negative times negative is positive). Next, perform the division: $12 \div (-3) = -4$ (positive divided by negative is negative). Finally, perform the addition: $32 + (-4) = 32 - 4 = 28$.  
@subject Quantitative Math  
@unit Numbers and Operations  
@topic Operations with Negatives  
@plusmarks 1

@question A school library received a donation of 45 boxes of books. Each box contains 18 books. If the librarian wants to distribute these books equally among 27 classrooms, how many books will each classroom receive?  
@instruction Choose the best answer.  
@difficulty moderate  
@Order 14  
@option 25 books  
@@option 30 books  
@option 35 books  
@option 40 books  
@explanation  
First, calculate the total number of books: $45 \text{ boxes} \times 18 \text{ books/box} = 810 \text{ books}$. Then, distribute the total books equally among 27 classrooms: $810 \text{ books} \div 27 \text{ classrooms} = 30 \text{ books/classroom}$.  
@subject Quantitative Math  
@unit Numbers and Operations  
@topic Computation with Whole Numbers  
@plusmarks 1

@question How many distinct arrangements of the letters in the word "MISSISSIPPI" are possible?  
@instruction Select the correct number of distinct arrangements.  
@difficulty moderate  
@Order 15  
@@option 34,650  
@option 69,300  
@option 831,600  
@option 39,916,800  
@explanation  
The word "MISSISSIPPI" has 11 letters in total. The letters are: M (1 time), I (4 times), S (4 times), P (2 times). The number of distinct arrangements is given by the formula for permutations with repetition: $n! / (n\_1! n\_2!... n\_k!)$, where $n$ is the total number of letters and $n\_i$ is the frequency of each distinct letter. \(11! / (1! \cdot 4! \cdot 4! \cdot 2!) = 39,916,800 / (1 \cdot 24 \cdot 24 \cdot 2) = 39,916,800 / 1152 = 34,650\).  
@subject Quantitative Math  
@unit Data Analysis & Probability  
@topic Counting & Arrangement Problems  
@plusmarks 1

@question A circular swimming pool has a circumference of $20\pi$ meters. What is the area of the pool?  
@instruction Select the correct area of the pool.  
@difficulty moderate  
@Order 16  
@option $10\pi$ m$^2$  
@option $40\pi$ m$^2$  
@@option $100\pi$ m$^2$  
@option $400\pi$ m$^2$  
@explanation  
First, use the circumference formula $C = 2\pi r$ to find the radius $r$. Given $C = 20\pi$ m, we have $20\pi = 2\pi r$, which simplifies to $r = 10$ m. Next, use the area formula $A = \pi r^2$ to find the area. Substituting $r=10$, we get $A = \pi (10)^2 = 100\pi$ m$^2$.  
@subject Quantitative Math  
@unit Geometry and Measurement  
@topic Circles (Area, circumference)  
@plusmarks 1

@question Point A has coordinates $(x, -2)$ and point B has coordinates $(1, 3)$. If the distance between A and B is $\sqrt{74}$ units, what is a possible value for $x$?  
@instruction Select the correct value for $x$.  
@difficulty moderate  
@Order 17  
@option $x = -6$  
@option $x = -4$  
@option $x = 0$  
@@option $x = 8$  
@explanation  
The distance formula between two points $(x\_1, y\_1)$ and $(x\_2, y\_2)$ is $D = \sqrt{(x\_2 - x\_1)^2 + (y\_2 - y\_1)^2}$.  
Given points A$(x, -2)$ and B$(1, 3)$, and distance $D = \sqrt{74}$.  
Substituting the values into the formula:  
$\sqrt{74} = \sqrt{(1 - x)^2 + (3 - (-2))^2}$  
$\sqrt{74} = \sqrt{(1 - x)^2 + (3 + 2)^2}$  
$\sqrt{74} = \sqrt{(1 - x)^2 + 5^2}$  
$\sqrt{74} = \sqrt{(1 - x)^2 + 25}$  
Square both sides to eliminate the square root:  
$74 = (1 - x)^2 + 25$  
Subtract 25 from both sides:  
$74 - 25 = (1 - x)^2$  
$49 = (1 - x)^2$  
Take the square root of both sides:  
$\pm\sqrt{49} = 1 - x$  
$\pm 7 = 1 - x$  
This gives two possible cases:  
Case 1: $7 = 1 - x \implies x = 1 - 7 \implies x = -6$  
Case 2: $-7 = 1 - x \implies x = 1 + 7 \implies x = 8$  
Both $x = -6$ and $x = 8$ are possible values. Among the given options, $x = 8$ is present.  
@subject Quantitative Math  
@unit Geometry and Measurement  
@topic Coordinate Geometry  
@plusmarks 1

@question Evaluate the expression: $75 \div (3 \times 5) + 4^2 - 10$.  
@instruction Select the correct value of the expression.  
@difficulty moderate  
@Order 18  
@@option 11  
@option 16  
@option 21  
@option 31  
@explanation  
According to the order of operations (PEMDAS/BODMAS):  
1. Parentheses: $(3 \times 5) = 15$. The expression becomes $75 \div 15 + 4^2 - 10$.  
2. Exponents: $4^2 = 16$. The expression becomes $75 \div 15 + 16 - 10$.  
3. Division: $75 \div 15 = 5$. The expression becomes $5 + 16 - 10$.  
4. Addition and Subtraction (from left to right): $5 + 16 = 21$. $21 - 10 = 11$.  
Therefore, the value of the expression is 11.  
@subject Quantitative Math  
@unit Numbers and Operations  
@topic Order of Operations  
@plusmarks 1

@question A survey asked 200 people about their preferred mode of transportation to work. 40% preferred driving, 30% preferred public transport, 20% preferred cycling, and the rest preferred walking. How many more people preferred driving than walking?  
@instruction Analyze the given percentages and total number of people to find the difference between two categories.  
@difficulty moderate  
@Order 19  
@option 40  
@option 50  
@@option 60  
@option 70  
@explanation  
Total people surveyed = 200. People preferring driving = 40\% of 200 = 0.40 \* 200 = 80. The sum of percentages for driving, public transport, and cycling is 40\% + 30\% + 20\% = 90\%. Therefore, the percentage of people preferring walking is 100\% - 90\% = 10\%. People preferring walking = 10\% of 200 = 0.10 \* 200 = 20. The difference between those preferring driving and walking is 80 - 20 = 60.  
@subject Quantitative Math  
@unit Problem Solving  
@topic Data Analysis  
@plusmarks 1

@question A small online retailer tracked the monthly sales (in USD) for two new product lines, 'Eco-Gadgets' and 'Smart-Home Devices', over the first six months of the year: \* \*\*Eco-Gadgets:\*\* January: $5,000; February: $5,500; March: $5,200; April: $5,800; May: $6,000; June: $5,900.  
\* \*\*Smart-Home Devices:\*\* January: $3,000; February: $3,500; March: $4,000; April: $4,500; May: $5,000; June: $5,500. Based on this data, which of the following is the most accurate inference about the sales trends of these two product lines?  
@instruction Select the most accurate inference based on the provided sales data.  
@difficulty moderate  
@Order 20  
@option Eco-Gadgets consistently outsold Smart-Home Devices by at least $2,000 each month.  
@@option Smart-Home Devices demonstrated a consistent month-over-month sales increase, while Eco-Gadgets' sales fluctuated but showed an overall upward trend.  
@option Both product lines experienced a steady decline in sales over the six-month period.  
@option By June, Smart-Home Devices had surpassed Eco-Gadgets in monthly sales.  
@explanation  
Let's analyze the trends:  
\* \*\*Smart-Home Devices:\*\* Sales increased consistently by $500 each month ($3,000 -> $3,500 -> $4,000 -> $4,500 -> $5,000 -> $5,500). This is a consistent month-over-month increase.  
\* \*\*Eco-Gadgets:\*\* Sales were $5,000 -> $5,500 -> $5,200 (dip) -> $5,800 -> $6,000 -> $5,900 (dip). While there were minor fluctuations (dips in March and June), the overall trend from January ($5,000) to June ($5,900) is upward. Therefore, option B accurately describes both trends. Option A is incorrect because the difference was not consistently at least $2,000 (e.g., in June it was $5,900 - $5,500 = $400). Option C is incorrect as both lines showed an increase. Option D is incorrect because in June, Eco-Gadgets ($5,900) still outsold Smart-Home Devices ($5,500).  
@subject Quantitative Math  
@unit Data Analysis & Probability  
@topic Trends & Inferences  
@plusmarks 1

@question Factor the expression \(3x^2 - 10x - 8\).  
@instruction Factor the given polynomial expression.  
@difficulty moderate  
@Order 21  
@@option \((3x+2)(x-4)\)  
@option \((3x-2)(x+4)\)  
@option \((3x+4)(x-2)\)  
@option \((3x-4)(x+2)\)  
@explanation  
To factor \(3x^2 - 10x - 8\), we look for two binomials of the form \((ax+b)(cx+d)\). We need \(ac=3\), \(bd=-8\), and \(ad+bc=-10\). By testing combinations, we find that \((3x+2)(x-4)\) works: \((3x)(x) = 3x^2\), \((2)(-4) = -8\), and the sum of the outer and inner products is \((3x)(-4) + (2)(x) = -12x + 2x = -10x\).  
@subject Quantitative Math  
@unit Algebra  
@topic Polynomial Expressions (FOIL/Factoring)  
@plusmarks 1

@question A factory needs to produce 1000 units of a product. Worker P produces 20 units per hour, and Worker Q produces 30 units per hour. They both start working at 9:00 AM. At 1:00 PM, Worker P leaves the factory. Worker Q continues working alone until all 1000 units are produced. At what time does Worker Q finish the production?  
@instruction Select the correct time.  
@difficulty moderate  
@Order 22  
@option 3:00 PM the next day  
@@option 3:40 PM the next day  
@option 4:00 PM the next day  
@option 4:40 PM the next day  
@explanation  
From 9:00 AM to 1:00 PM, both workers work together for 4 hours. Their combined rate is $20 + 30 = 50$ units/hour. In 4 hours, they produce $50 \times 4 = 200$ units. The remaining units to be produced are $1000 - 200 = 800$ units. Worker Q continues alone at a rate of 30 units/hour. The time needed for Worker Q to produce the remaining units is $800 / 30 = 80/3$ hours. $80/3$ hours is equal to $26 \frac{2}{3}$ hours. $2/3$ of an hour is $(2/3) \times 60 = 40$ minutes. So, Worker Q works for an additional 26 hours and 40 minutes starting from 1:00 PM. Adding 26 hours and 40 minutes to 1:00 PM: 1:00 PM + 24 hours = 1:00 PM the next day. Then, 1:00 PM + 2 hours + 40 minutes = 3:40 PM the next day. Therefore, Worker Q finishes production at 3:40 PM the next day.  
@subject Quantitative Math  
@unit Problem Solving  
@topic Problem Solving  
@plusmarks 1

@question Which of the following values is the smallest?  
@instruction Compare the given numbers and identify the smallest one.  
@difficulty moderate  
@Order 23  
@option $0.35$  
@option $3/8$  
@@option $33\%$  
@option $1/3$  
@explanation  
To compare these values, convert them all to decimals: \\ $0.35$ remains $0.35$. \\ $3/8 = 0.375$. \\ $33\% = 33/100 = 0.33$. \\ $1/3 \approx 0.3333$. \\ Comparing $0.35$, $0.375$, $0.33$, and $0.3333...$, the smallest value is $0.33$, which corresponds to $33\%$.  
@subject Quantitative Math  
@unit Numbers and Operations  
@topic Fractions, Decimals, & Percents  
@plusmarks 1

@question Calculate the volume of a sphere with a radius of 3 cm. Use $\pi \approx 3.14$.  
@instruction Select the correct volume.  
@difficulty moderate  
@Order 24  
@@option $113.04 \text{ cm}^3$  
@option $37.68 \text{ cm}^3$  
@option $84.78 \text{ cm}^3$  
@option $28.26 \text{ cm}^3$  
@explanation  
The formula for the volume of a sphere is $V = \frac{4}{3}\pi r^3$. Given a radius $r = 3 \text{ cm}$ and $\pi \approx 3.14$, we calculate the volume as follows: $V = \frac{4}{3} \times 3.14 \times (3 \text{ cm})^3 = \frac{4}{3} \times 3.14 \times 27 \text{ cm}^3 = 4 \times 3.14 \times 9 \text{ cm}^3 = 36 \times 3.14 \text{ cm}^3 = 113.04 \text{ cm}^3$.  
@subject Quantitative Math  
@unit Geometry and Measurement  
@topic Area & Volume  
@plusmarks 1

@question What is the equation of a line that is perpendicular to the line $y = 2x + 5$ and passes through the point $(4, -1)$?  
@instruction Select the correct equation.  
@difficulty moderate  
@Order 25  
@@option $y = -\frac{1}{2}x + 1$  
@option $y = 2x - 9$  
@option $y = \frac{1}{2}x - 3$  
@option $y = -2x + 7$  
@explanation  
The given line $y = 2x + 5$ has a slope $m\_1 = 2$. A line perpendicular to it will have a slope $m\_2$ such that $m\_1 \cdot m\_2 = -1$. Therefore, $2 \cdot m\_2 = -1$, which means $m\_2 = -\frac{1}{2}$. \nNow, use the point-slope form $y - y\_1 = m(x - x\_1)$ with the point $(4, -1)$ and slope $m = -\frac{1}{2}$: \n$y - (-1) = -\frac{1}{2}(x - 4)$ \n$y + 1 = -\frac{1}{2}x + 2$ \nSubtract 1 from both sides: \n$y = -\frac{1}{2}x + 1$  
@subject Quantitative Math  
@unit Geometry and Measurement  
@topic Parallel & Perpendicular Lines  
@plusmarks 1