

Section A. Each correct answer is worth 1 point.

1. List three natural numbers.
 2. Two lines that do not lie in the same plane are said to be ?.
 3. Solve for all real numbers: $x^3 = 9x$.
 4. $\sqrt{150}$ is between what two whole numbers?
 5. Express $(5\sqrt{3})^2$ in simplest form.
 6. Find the midpoint of the segment whose endpoints are (1000, -3000) and (-3004, 2004).
 7. The ratio of rocks to rolls is 2 to 3, and there are 2004 more rolls than rocks.
How many rolls are there?
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Section B. Each correct answer is worth 2 points.

8. Solve for m in terms of n : $am - bn = cmn$.
 9. Simplify completely: $\frac{x^3 - x^2 - 6x}{x^2 + x - 12}$.
 10. Express as a rational number in simplest form: $3^{-2} - (-2)^{-3}$.
 11. Solve for x and y ; express as an ordered pair (x, y) : $\begin{cases} x + y = 11 \\ 3x - 2y = 13 \end{cases}$
 12. Given $f(x) = x^2 - x - 1$ and $g(x) = 2x + 3$. If $f(x) = 1$, find all values of $g(x)$.
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Section C. Each correct answer is worth 3 points.

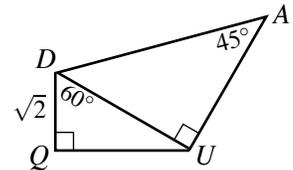
13. $2004_{\text{six}} = \underline{\quad?}\text{ five}$ (The subscripts “six” and “five” mean those numbers are written in base 6 and base 5. For example, $23_{\text{six}} = 15_{\text{ten}}$.)
14. Solve for all values of x : $\sum_{n=0}^4 (n!) - \sum_{n=0}^4 n = x^2 - 25$.
15. If $\log_2[\log_3(\log_4 b)] = \log_4[\log_3(\log_2 a)] = 0$, find the ratio of a to b .
Express in simplest form.

Section A. Each correct answer is worth 1 point.

1. A plane quadrilateral has integral sides of 1, 2, 4, and x . Find all possible values of x .
2. Express in simplest form: $\frac{a^{4n+3}}{a^{3n-2}}$.
3. Write all solutions which are real and rational: $x(x^2 + 4)(x^2 - 36)(x^2 - 5)(x + 0.7) = 0$.
4. Write the converse of "If Browns, then not Bengals."
5. Give the last name of either (not both) of the two independent inventors of calculus.
6. The hypotenuse of a right triangle is 58, and one of the legs is 40. Find the length of the shortest side of that right triangle.
7. A single die (number cube) is rolled three times. What is the probability that the same number comes up all three times? Express as a fraction in simplest form.

Section B. Each problem is worth 2 points.

8. The six-digit number $2a00b4$ is divisible by 9 and divisible by 11. What is the number?
9. Find the exact perimeter of quadrilateral $QUAD$ on the right.
10. Solve for x : $\begin{vmatrix} 1 & x & 2 \\ 3 & 0 & 4 \\ -1 & 3 & -2 \end{vmatrix} = 2004$.
11. Solve for x : $|2x + 5| - 11 = 2004$.
12. Solve for all real values of x , correct to the nearest thousandth:



$$0.2x^3 + 0.5x^2 - x + 2003 = 2004.$$

Section C. Each problem is worth 3 points.

13. A set of five natural numbers has a mean, median, and mode. The mean is 2004. Two of the numbers are 1900 and 1963. If the median is 2 less than the mode, write the value of the mode.
14. In right $\triangle ABC$, $m\angle A = 20.04^\circ$, and the right angle is at C . Find the numerical value of $\sin^2 A + \sin^2 B + \sin^2 C$.
15. A square pyramid has a base with perimeter 48 cm, and slant height 10 cm. Find the volume of the pyramid. Be sure to include the correct units.