IPS3 Diagnostic Exam

Transfer Exam

Introduction

Students come into the IPS program from all parts of the world, at all levels of English, as well as at various levels of mathematics proficiency. Rather than picking any country's standard of math at this grade level, the IPS Mathematics department has decided to test on the content that is most relevant to students entering the IPS program. That content is outlined in the following pages and there are example problems for each topic tested.

In addition, examinees are responsible for interpreting mathematical symbols and units where notation and measurements may be different from standards students are used to. Some examples of different issues students may encounter include:

- Comma usage, or their absence, for large numbers (e.g., $1\,000\,000 = 1000000 = 1,000,000$)
- Period usage and leading zeroes for decimals (e.g., $0.01 = .01$)
- Units and their abbreviations ("kilograms" becomes "kg", "centimeters" becomes "cm", etc). Understanding the units will generally not affect whether the student can answer the problem.

Furthermore, effort is made to try and simplify the vocabulary used in word problems, but students are expected to understand mathematical vocabulary appropriate of this grade level. Many of the examples that follow illustrate this point.

Last, the exam is 10 two-mark questions, 6 three-mark questions, and 3 four-mark questions, totaling to 50 marks. Students have 25 minutes to finish the math portion of the IPS diagnostic exams, averaging to a little over 1 minute per question. If a student finds themselves spending too much time on one question, they are encouraged to skip it and come back to it later provided there is time remaining.

Topic 1 – Geometry

This topic is the smallest part of the exam at roughly 10% of total marks. Example problems revolve around properties of polygons and include:

1. What is the measure of one of the interior angles of a regular hexagon?
2. A quadrilateral is constructed such that three of its angles measure $10°, 30°$, and $130°$. Find the measure of the remaining angle.

Topic 2 – Radicals

This topic makes up the next smallest part of the exam at roughly 15% of total marks. Example problems from this topic include:

1. Simplify:
   a. $\sqrt{80}$
   b. $\sqrt{5} \cdot (\sqrt{5} + 5)$
   c. $\sqrt{8} + \sqrt{12} + \sqrt{50}$

Topic 3 – Simplifying and Factoring Expressions

This is the largest topic of the exam, making up roughly 40% of total marks. Example problems from this topic include:

1. Simplify:
   a. $\frac{1}{3}(3x)^2$
   b. $\left(\frac{1}{3} \times \frac{x}{y^2}\right)^3$
2. Factor fully each of the following:
   a. $x^2 - 9$
   b. $x^2 - 8x + 15$
   c. $18x^2y^2 - 36xy$
3. Expand and simplify $(2 - x)(x + 1) + \frac{1}{4}(2x - 2)^2$.

Topic 4 – Solving and working with equations in 1- and 2-variables

This is the second largest section of the exam, making up roughly 35% of total marks. Many questions from this topic are about properties of lines. Example problems include:

1. Solve for the missing variable from $3x = 5(x - 2) - 8$.
2. Find the midpoint between $A = (-5,1)$ and $B = (\frac{1}{2}, -4.5)$.
3. Find the slope and y-intercept of the linear function $2x - 3y + 1 = 0$.
4. Solve the following system of equations:
$$\begin{cases} x + 2y = 3 \\ 3x + 2y = 1 \end{cases}$$
5. Find the point of intersection of lines f and g.
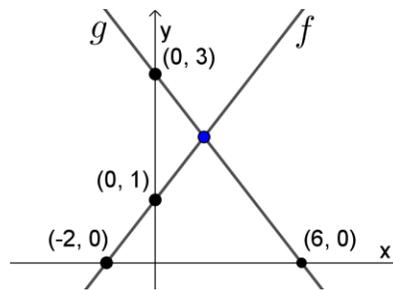
Solutions

Topic 1

1. 120°
2. 190°

Examiner's note: the answer sheets will already include the correct units for any problems that have them, so students do not need to concern themselves with that aspect of the problem.

Topic 2

a. $4\sqrt{5}$
b. $5 + 5\sqrt{5}$ (reverse order okay)
c. $7\sqrt{2} + 2\sqrt{3}$ (reverse order okay)

Topic 3

1.
    a. $3x^2$
    b. $\frac{x^3}{27y^6} = \frac{1}{27} \cdot \frac{x^3}{y^6}$
2.
    a. $(x + 3)(x - 3)$
    b. $(x - 3)(x - 5)$
    c. $18xy(xy - 2)$
3. $-x + 3$

Examiner's note: like Topic 2 solutions, students can write their solutions in reverse order than those provided, though students should be aware if instructed otherwise.

Topic 4

1. 9
2. $(-2.25, -1.75)$ or $\left(-2\frac{1}{4}, -1\frac{3}{4}\right)$ or $\left(-\frac{9}{4}, -\frac{7}{4}\right)$
3. slope $= \frac{2}{3}$ or $0.\overline{6}$, $y - \text{int} = \frac{1}{3}$ or $0.\overline{3}$
4. $(-1,2)$
5. $(2,2)$

Examiner's note: the answer sheets will include the form expected from students, e.g., as a coordinate or in terms of $x =$ and $y =$, so students do not need to concern themselves with that aspect of the problem. Also, unless otherwise specified, students will be given credit for answers written as an improper fraction, mixed number, or decimal.