

# THE INTERNATIONAL MEDICAL ADMISSIONS TEST (IMAT) SPECIFICATION

In partnership with Ministero dell'Istruzione, dell'Università e della Ricerca (MIUR), the Italian Ministry of Higher Education and Research

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## **The International Medical Admission Test (IMAT)**

The International Medical Admissions Test (IMAT) is a subject-specific admissions test in English, designed by Cambridge Assessment, for applicants to Medicine and Surgery courses at Italian International Medical Schools.

These courses are taught in English, with places open to both home and international students. Cambridge Assessment works in conjunction with the Italian Ministry of Higher Education and Research (MIUR) to develop and deliver IMAT, which is the English language equivalent of the Italian admissions test used for entry to medical degrees taught in Italian.

## **Test Specification**

### **Test Format**

IMAT is a pen-and-paper test, consisting of a total of 60 multiple-choice questions divided into four sections. All questions have five options, of which only one is correct. Candidates have 100 minutes to complete the test and the format is as follows:

### **Section 1**

10 questions - Logical Reasoning 12 questions - General Knowledge

## **Section 2**

18 questions - Biology

## **Section 3**

12 questions - Chemistry

## **Section 4**

8 questions - Physics and Mathematics

## **Scoring**

A candidate's total score is calculated using the following formula:

1.5 points for each correct answer; -0.4 points for each wrong answer; 0 points for each question not answered.

An overall total score (maximum 90 points) will be reported, together with a score on each of Logical Reasoning, General Knowledge, Biology, Chemistry, Physics and Mathematics.

## **Level of Difficulty**

The level of difficulty of the test items will be targeted to discriminate effectively between applicants, including those who may have achieved the highest possible grades in school examinations.

## **Section 1: General Knowledge and Logical Reasoning**

Section 1 will assess general knowledge and the thinking skills that students must possess in order to succeed in a course of study at the highest level. Such skills are basic to any academic studies, which often require students to solve novel problems, or consider arguments put forward to justify a conclusion, or to promote or defend a particular point of view.

## ***General Knowledge***

General Knowledge questions may address a range of cultural topics, including aspects of literary, historical, philosophical, social and political culture.

These questions are not based on any specific part of school curricula; rather their aim is to test the candidates' interest and knowledge in a wide variety of fields. Candidates with a keen extra-curricular interest in current events who regularly keep up to date with national and international news will be better prepared to answer this type of question.

Which country was governed by the Taliban's theocratic regime from 1996 to 2001?

- . **A** Afghanistan
- . **B** Iran
- . **C** Iraq
- . **D** Saudi Arabia
- . **E** Syria

Here the correct answer is **A. *Logical Reasoning***

The questions in this section evaluate candidates' thinking skills, reasoning skills and analytical skills, especially the ability to follow the logical steps in different contexts, to recognise fallacies in the argument, to solve problems, and to discern relevant from irrelevant information.

More specifically, there are two types of logical reasoning questions:

- Critical thinking: questions that involve reasoning using everyday written language. Questions focus on the skills involved in understanding and evaluating arguments.
- Problem Solving: questions that involve reasoning using numerical and spatial skills. In order to successfully answer these questions, candidates must employ a logical approach. No previous knowledge of any particular subject is necessary and all the information required to answer them is included in the question. Candidates are strongly encouraged to familiarize themselves with the different types of questions by reading this guide.

### ***Critical Thinking***

In this category there are 7 different specific types of questions that can appear in this section of the test:

1. Summarising the main conclusion
2. Drawing a conclusion
3. Identifying an assumption
4. Assessing the impact of additional evidence
5. Detecting reasoning errors
6. Identifying parallel reasoning
7. Applying principles

#### **1. Summarising the Main Conclusion**

There has been a decline in the rate of many of the illnesses of old age. The causes of this decline include such medical advances as

new drugs and surgical techniques. There is, however, another factor. The present generation of 60- and 70-year-olds had much better nutrition as children than did their parents. Good nutrition in childhood is important for good health in adulthood. Since improvements in nutrition have continued over the past sixty years, we can expect that many of the illnesses of old age will continue to decline.

Which one of the following best expresses the main conclusion of the above argument?

- . **A** We can expect that improvements in nutrition will continue.
- . **B** The rate of many of the illnesses of old age has declined.
- . **C** Medical advances have significantly reduced the rate of diseases of old age.
- . **D** The fall in the rate of many of the illnesses associated with old age will continue.
- . **E** Improvements in nutrition have been very important in maintaining good health in old age.

In this type of question you have to judge which one of the statements A to E best expresses the main conclusion of the argument. The conclusion can appear anywhere within an argument - not necessarily at the end. What you are looking for is the statement which follows from, or is supported by the rest of the passage.

In this case, **D** is the correct answer.

## **2. Drawing a Conclusion**

The demand for blood donors is increasing all over the world. In Western countries, in particular, demand has been rising so rapidly

that shortages have begun to appear. In all such countries, demand is growing much faster than rates of growth in populations aged 18–65, and it is this group who are the major blood donors. And, despite a massive research effort to find alternatives, it remains true that in medicine there is no substitute for human blood.

Which one of the following conclusions can be drawn from the passage?

- . **A** As the demand for blood has increased, so has the supply fallen.
- . **B** The rate of growth of the blood-donor population has been slowing recently.
- . **C** The increase in the rate of demand for blood is mainly due to population growth.
- . **D** If more blood donors could be found, there would be no need to find a substitute for human blood.
- . **E** The problem of the increase in demand for blood shows no sign of disappearing.

In this type of question you are asked which conclusion follows from the information given. You need to consider each of the statements A to E, and to think about whether the information in the passage gives you good reasons to accept the statement.

In this case, **E** is the correct answer. **3. Identifying an Assumption**

Success in modern America is very much measured by the quantity of material possessions one has. A lack of material possessions means one is judged to be unsuccessful. Those people with few material possessions therefore must feel a strong sense of failure.

Which one of the following is an underlying assumption of the



above argument?

- . **A** Most modern Americans are successful.
- . **B** Success can be precisely measured.
- . **C** People in America with few material possessions want to be seen as successful.
- . **D** Excessive desire for material possessions is psychologically damaging.
- . **E** Over-emphasis on material possessions creates social problems.

An assumption is something which is not stated in the argument, but which is taken for granted in order to draw the conclusion. So you need first to identify the conclusion of the argument. Then look for the reasoning it gives to support this conclusion, and think about any important point which is not actually stated in the reasoning.

In this case, **C** is the correct answer.

#### **4. Assessing the Impact of Additional Evidence**

Zoos are entirely unsuitable places for animals. People visit zoos to learn about animal behaviour but the animals they see are likely to be behaving in abnormal and neurotic ways because of the cramped and unnatural conditions in which they are kept. Zoos should be closed and the money saved should be used for the protection of natural habitats.

Which one of the following, if true, would most weaken the above argument?

- . **A** Humans living in cramped conditions can also become neurotic

- . **B** Zoos enable endangered species to survive by breeding them in captivity and then re- introducing them to the wild
- . **C** Many of the animals at present in zoos would not be capable of living in the wild
- . **D** The protection of natural habitats is very costly
- . **E** Schoolchildren can learn a great deal about animals from visiting zoos

This type of question will typically ask you to consider what would weaken or strengthen an argument. You need first to be clear about what the argument is trying to establish. Work out what the conclusion is, and then consider what effect each of the possible answers would have on the conclusion.

In this case, **B** is the correct answer. **5. Detecting Reasoning Errors**

In order to succeed in academic examinations it is necessary to study. Therefore, if a student works hard in a particular subject, he or she should do well when it comes to the examination.

Which one of the following best describes the flaw in the argument?

- . **A** It assumes that it is necessary to study in order to succeed.
- . **B** It overestimates the value of studying in preparation for examinations.
- . **C** It ignores the fact that some subjects are more academic than others.
- . **D** It assumes that studying hard is a sufficient condition for academic success.



- . **E** It ignores the fact that some students do not need to study very much in order to succeed.

This type of question asks you to identify the flaw in the argument, which means that you must explain why the conclusion does not follow from the reasons which are given. So you need to be clear about what the conclusion is, and what reasons are meant to support it.

In this case, **D** is the correct answer.

## **6. Identifying parallel reasoning**

If you want to earn a good salary these days, you have to gain considerable experience of working abroad. Since I have always wanted to earn a huge salary, it's obvious that I'm going to have leave this country for some period of time.

Which one of the following most closely parallels the reasoning used in the above argument?

- . **A** If I had more time to spend on this project, I know that it would be very successful. I've been told that I'm not going to be given enough time, so the project isn't going to succeed.
- . **B** Sam knew that if he wanted to write a film script, he would have to learn the special techniques needed for such scripts. He has enrolled on a course to learn how to write them, so he'll soon be writing his first script.
- . **C** If the Ambassador can bring the two sides together for talks, there's a good chance of peace. Peace is something that both sides want, so he'll be talking to both sides soon.
- . **D** If the doctor thinks that you should be allowed out of bed for a short while, then you must be recovering well from your

operation. You have recovered much quicker than she thought you would, so you'll be out of bed a lot from now on.

- . **E** Annie says that if she really wants to win the race, she'll have to train very hard every day. She told me that she is determined to win the race, so that means she'll be working hard on her training programme every day from now on.

This type of question asks you to identify similar arguments, but not similarity of topic. You need to look for similarity in the structure or pattern of the argument. So you must identify the structure of the argument and then consider each option to identify an argument with the same structure.

Here the correct answer is **E**.

## **7. Applying Principles**

Smokers who suffer from heart disease which is caused by their smoking should not be allowed to get free health treatment. That is because this is an example of self-inflicted illness. Those whose actions have caused illness or injury to themselves should make a financial contribution to their treatment.

Which one of the following best illustrates the principle underlying the argument above?

- . **A** Children should get free dental treatment, even if they eat sweets which cause dental decay.
- . **B** Motor cyclists whose head injuries are caused by not wearing a crash helmet should make a financial contribution to their treatment.
- . **C** Smokers who cannot afford to pay for healthcare should be allowed free treatment when they are ill.

- . **D** People who are injured in car accidents should receive free treatment regardless of whether they were wearing a seat belt.
- . **E** Heart disease sufferers who can afford to pay for health treatment should not receive free treatment.

This type of question asks you to identify which statement illustrates the principle underlying the passage. A principle is a general recommendation, which in the passage will be applied to just one particular case, but which could also be applied to other cases. In order to answer this type of question, you must first identify this principle and then consider each of the options to see which one follows from that principle.

The correct answer is **B**.

### ***Problem Solving***

There are three kinds of problem solving questions:

1. Relevant Selection
2. Finding Procedures
3. Identifying Similarity

Although most questions fall into only one category, some questions fit into more than one of the categories.

#### **1. Relevant Selection**

The following table gives figures for the percentage growth per year of labour productivity per person per year in various countries during three periods.

Japan

France

Sweden

Period 1

Period 2

3.0

Period 3

8.5

3.0

3.2

5.4

2.6

United Kingdom

Belgium

3.6

1.5

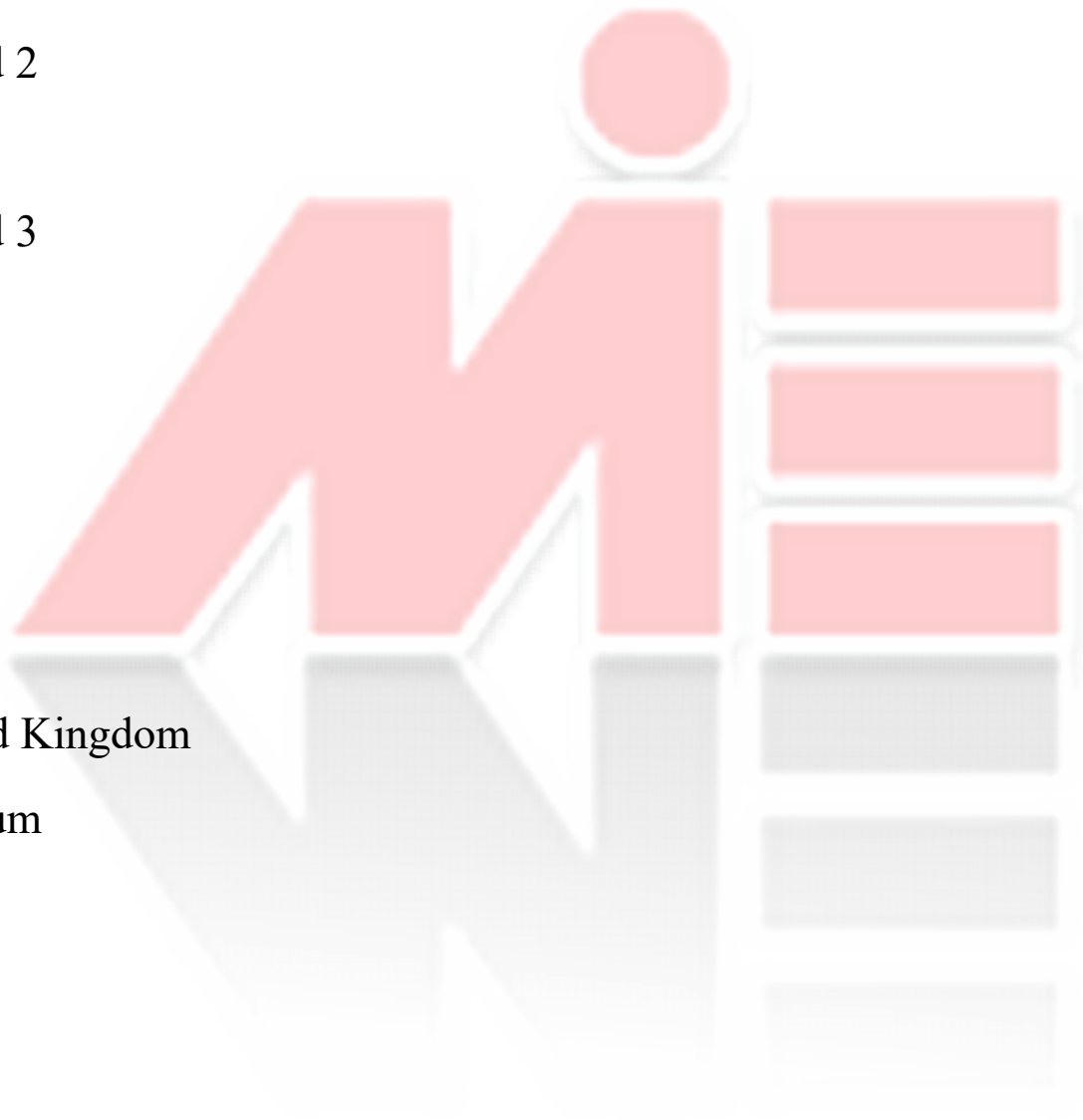
2.8

2.4

3.3

2.3

4.1



1.5

1.8

Denmark

Netherlands

Germany

United States

4.3

2.2

2.6

0.0

1.7

Italy

6.3

4.8

3.0

2.7

1.6

1.6

4.5

3.1



1.6

0.8

Which country's percentage growth per year remained consistently greater than half of its Period 1 level in the following periods?

- . **A** Belgium
- . **B** Denmark
- . **C** France
- . **D** Germany
- . **E** United Kingdom

Very often a real world problem will be overloaded with information, much of which is unimportant. This kind of question demands Relevant Selection, in which the task is to select only that information which is necessary and helpful in finding a solution.

In this case, **A** is the correct answer.

## **2. Finding Procedures**

A child's bus fare is cheaper than the adult fare but is more than half the adult fare. The total cost of a single journey for an adult and two children is €1.20. Adult fares are all multiples of 10 cents.

What is the adult fare?

- . **A** 30 cents
- . **B** 40 cents
- . **C** 50 cents
- . **D** 60 cents



- . **E** 70 cents

Sometimes you will find that even if you have selected all the relevant information, no solution presents itself. For this type of question, you have to find a method or procedure which you can use to generate a solution.

In this case, **C** is the correct answer. **3. Identifying Similarity**

I wish to tile an area of wall 120 cm wide by 100 cm high. Tiles are 20 cm square. I will, therefore, need  $6 \times 5 = 30$  tiles.

Which one of the following uses the same method of calculation as that above?

- . **A** A staircase is 3 m high. Each step rises 0.25 m. Therefore, there are 12 steps.
- . **B** A room is 4.2 m by 2.0 m. Carpet costs €10.00 per square metre. Therefore, it will cost €84.00 to carpet the room.
- . **C** A box containing sugar cubes is 10 cm x 10 cm x 5 cm. A sugar cube is 1 cm on each side. Therefore, the box contains 500 cubes.
- . **D** Using square tables 1.5 m on each side, I need to make up a conference table 6 m x 3 m. Therefore I will need 8 tables.
- . **E** I work 40 hours a week and earn €5.00 an hour. Therefore, in 4 weeks I will earn €800.00.

In this type of question you will be presented with information and asked to identify the same information presented in a different way, or a situation in which different information has a similar structure.

Here the correct answer is **D**.

**Section 2: Biology Topics covered:**

## **The chemistry of living things**

The biological importance of weak interactions. Organic molecules in organisms and their respective functions. The role of enzymes.

## **The cell as the basis of life**

Cell theory. Cell size. Prokaryotic and eukaryotic cells, animal and plant cells. Viruses. The structure and function of the cell membrane and transport across the membrane. Cellular structures and their specific functions. Cell cycle and cell division: mitosis and meiosis - chromosomes and chromosome maps.

## **Bioenergetics**

The energy currency of cells: ATP. Redox reactions in living things. Photosynthesis, glycolysis, aerobic respiration and fermentation.

## **Reproduction and Inheritance**

Life cycles. Sexual and asexual reproduction. Mendelian genetics: Mendel's laws and their applications. Classical genetics: chromosomal theory of inheritance - inheritance patterns. Molecular genetics: structure and replication of DNA, the genetic code, protein synthesis. Prokaryotic DNA. Eukaryotic chromosome structure. Genes and regulation of gene expression.

Human genetics: mono- and multifactorial character transmission; hereditary diseases - autosomal and linked to chromosome X. Biotechnology: recombinant DNA technology and its applications.

## **Inheritance and environment**

Mutations. Natural and artificial selection. Evolutionary theories. The genetic basis of evolution.

## **Anatomy and physiology of animals and humans**

The animal tissues. Anatomy and physiology of systems in humans and their interactions. Homeostasis.

### **Section 3: Chemistry Topics covered:**

#### **The composition of matter**

States of matter; heterogeneous and homogeneous systems; compounds and elements. Ideal Gas Laws.

#### **Atomic structure**

Elementary particles; atomic number and mass number, isotopes, electronic structure of atoms of different elements.

#### **The periodic table of the elements**

Groups and periods; transition elements. Periodic properties of elements: atomic radius, ionization potential, electron affinity, metallic character. The relationships between electronic structure, position in the periodic table, and element properties.

#### **The chemical bond**

Ionic, covalent and metallic bonds. Binding energy. Polarity of bonds. Electronegativity. Intermolecular bonds.

#### **Fundamentals of inorganic chemistry**

Nomenclature and main properties of inorganic compounds: oxides, hydroxides, acids, salts.

#### **Chemical reactions and stoichiometry**

Atomic and molecular mass, Avogadro's number, mole concept and its application, elementary stoichiometric calculations, balancing simple reactions, different types of chemical reaction.

## **Solutions**

Solvent properties of water, solubility, the main ways of expressing the concentration of solutions. Equilibria in aqueous solution. Chemical kinetics and catalysis.

## **Oxidation and reduction**

Oxidation number, concept of oxidizing and reducing. Balancing of simple reactions.

## **Acids and bases**

The concept of acid and base. Acidity, neutrality and basicity of aqueous solutions. The pH scale. Hydrolysis. Buffer solutions.

## **Fundamentals of organic chemistry**

Bonds between carbon atoms, and crude formulas of structure, the concept of isomerism. Aliphatic, alicyclic and aromatic hydrocarbons. Functional groups: alcohols, ethers, amines, aldehydes, ketones, carboxylic acids, esters, amides. Chemical nomenclature.

## **Section 4: Physics & Mathematics**

### ***Physics***

#### **Topics covered: Measures**

Direct and indirect measures, fundamental and derived quantities, physical dimensions of quantities, knowledge of the metric system and the CGS System of Units, Technical (or practical) (ST) and International System (SI) units of measurement (names and relationships between fundamental and derived units), multiples and sub-multiples (names and values).

## **Kinematics**

Kinematic quantities, various types of motion with particular regard to uniform and uniformly accelerating rectilinear motion; uniform circular motion; harmonic motion (for all motions: definition and relationships between quantities).

## **Dynamics**

Vectors and vector operations. Forces, moments of forces about a point. Moment of a force couple. Vector composition of forces. Definition of mass and weight. Acceleration due to gravity. Density and specific gravity. The law of universal gravitation, 1st, 2nd and 3rd laws of motion. Work, kinetic energy, potential energy. Principle of conservation of energy. Impulse and momentum. Principle of conservation of momentum.

## **Fluid mechanics**

Pressure, and its unit of measure (not only in the SI system). Archimedes' Principle. Pascal's principle. Stevino's law.

## **Thermodynamics**

Thermometry and calorimetry. Thermal capacity and specific heat capacity. Modes of heat propagation. Changes of state and latent heats. Ideal Gas Laws. First and second laws of thermodynamics.

## **Electrostatic and electrodynamics**

Coulomb's law. Electric field and potential. Dielectric constant. Capacitors. Capacitors in series and in parallel. Direct current. Ohm's Law. Kirchhoff's Principles. Electrical resistance and resistivity, electrical resistances in series and in parallel. Work, Power, Joule effect. Generators. Electromagnetic induction and alternating currents. Effects of electrical currents (thermal, chemical

and magnetic).

## ***Mathematics***

### **Topics covered:**

#### **Algebra and numerical sets**

Natural numbers, integers, rational and real numbers. Sorting and comparison: scales and scientific notation. Operations and their properties. Proportions and percentages. Powers with integer and rational exponents, and their properties. Roots and their properties. Logarithms (base 10 and base  $e$ ) and their properties. Elements of combinatorics. Algebraic and polynomial expressions. Major products and  $n^{\text{th}}$  power of binomial expansions, factorisation of polynomials. Algebraic fractions. Algebraic equations and inequalities of the first and second order. Systems of equations.

#### **Functions**

Basic concepts of functions and their graphical representations (domain, codomain, sign, continuity, maxima and minima, increasing and decreasing, etc.). Elementary functions: whole and fractional algebraic functions; exponential, logarithmic, and trigonometric functions. Composite and inverse functions. Trigonometric equations and inequalities.

#### **Geometry**

Polygons and their properties. Circle and circumference. Measurements of lengths, surfaces and volumes. Isometries, similarities and equivalences in the plane. Geometric loci. Measurement of angles in degrees and radians. Sine, cosine, tangent of an angle and their significant values. Trigonometric formulas. Solving triangles. Cartesian reference system in a plane. Distance



between two points and the midpoint of a segment. Straight line equation. Conditions for parallel and perpendicular lines. Distance of a point to a line. Equation of the circle, the parabola, the hyperbola, the ellipse and their representation in the Cartesian plane. Pythagoras' theorem. Euclid's first and second theorems.

### **Probability and statistics**

Frequency distributions and their graphical representations. Concept of random experiments and events. Probability and frequency.

### **Specimen Biology, Chemistry, Physics and Mathematics Questions**

The diagram below shows a family tree of a condition known as nail patella syndrome (NPS).

12

345 6

789 Key

female without NPS female with NPS

male without NPS male with NPS

Which of the following pairs of individuals **must** be heterozygous for NPS?

**A** 1and5 **B** 2and6 **C** 3and7 **D** 4and8 **E** 5and9

Here the correct answer is **D**.

An oxide of iron has the formula  $\text{Fe}_3\text{O}_4$  and contains both  $\text{Fe}^{2+}$  and  $\text{Fe}^{3+}$  ions. Which one of the following is the fraction of iron ions

that are in the  $\text{Fe}^{2+}$  state?

$\frac{1}{4}$   $\frac{1}{3}$   $\frac{1}{2}$   $\frac{2}{3}$   $\frac{3}{4}$

**A B C D E**

Here the correct answer is **B**.

Below are four statements about thermal (heat) energy.

**1** A substance can lose heat energy without its temperature falling. **2** Heat energy can pass through a vacuum. **3** Steam at  $100^{\circ}\text{C}$  has more heat energy than the same mass of boiling water at  $100^{\circ}\text{C}$  **4** When a container of water is cooled near the top, a convection current is set up in the water.

Which statements are correct?

**A** 1,2and3only **B** 2,3and4only **C** 1,2and4only **D** 1,3and4only **E** 1,2,3and4

Here the correct answer is **E**.

The longest side of a right angled triangle is 6 + One of the shorter sides is 3 + 2 5 units. What is the length of the third side?

**A**23

5 units.

70+24 5 **C** 12

**D**3–5**E** 14+7.5 5

**B**

Here the correct answer is **A**.

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