Grade 9 Math, Explained

Final Exam Model Paper 3

MODEL PAPER

Full marks 75 · 3 hours

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 75

All questions are compulsory. Time: 3 hours.

A practice paper by Science Playground, made to CDC's Specification Grid 2078, Mathematics, Grades 9–10; not an official CDC or exam board paper. Mark it yourself online: the QR code below opens the paper with its answers.

A full practice run of the Grade 9 final exam in Compulsory Mathematics: 75 marks in 3 hours, 16 questions, every one compulsory. The marks of each part are in brackets. Show your working on paper as in the exam hall, then open each part's answer and give yourself the marks its scheme allows. You need a ruler, a compass and a protractor for Questions 11 and 12. Use $\pi = \frac{22}{7}$ where it is needed.

Question 1 — 6 marks

$U = \{x : x$ is a natural number from 1 to 15$\}$ is the universal set of $P = \{$prime numbers$\}$, $S = \{$square numbers$\}$ and $E = \{$even numbers$\}$.

a. Write the cardinal number of the set E. **[1]**

b. Show the sets P, S and E in a Venn diagram. **[1]**

c. Prove by listing the elements: $\overline{P \cap E} = \overline{P} \cup \overline{E}$ **[3]**

d. What is the relation between the sets P and S? Give a reason. **[1]**

Question 2 — 5 marks

Ishwori is a computer engineer at a company in Lalitpur. Her monthly salary is Rs 1,10,000, and she gets 13 months' salary in a year, including the festival allowance. Every month she deposits 10% of her monthly salary in the Citizen Investment Trust, which the law allows to be taken off her income. Her only income is her salary. The income tax rates for 2083/84 are:

Taxable income in a year	Rate
the first Rs 10,00,000	1%
the next Rs 5,00,000 (Rs 10 lakh to 15 lakh)	10%
the next Rs 10,00,000 (Rs 15 lakh to 25 lakh)	20%

A woman whose only income is from employment gets 10% off her income tax.

a. What is the 1% tax on the first band of income called? **[1]**

b. Find Ishwori's taxable income for the year. **[2]**

c. How much income tax does she pay in the year? **[2]**

Question 3 — 3 marks

A dairy cooperative in Chitwan made a profit of Rs 72,00,000 this year. It pays 10% of its profit as a bonus, shared equally among its 48 employees.

a. What is a bonus? **[1]**

b. How much bonus does each employee get? **[1]**

c. Next year the profit falls by 20%, and the cooperative has 2 more employees. With the same rate of bonus, by how much does each employee's bonus fall? **[1]**

Question 4 — 5 marks

Bibek's family lives in Bhaktapur. Use these rates:

Water, ½ inch pipe (KUKL)	Electricity, 5 A meter (NEA)	Taxi
Rs 100 for the first 10 units, then Rs 32 a unit; sewerage charge 50% of the water charge	Minimum charge: Rs 75 for 51 to 100 units. Energy charge: the first 20 units Rs 3 each, the next 10 Rs 6.50, the next 20 Rs 8, then Rs 9.50	Day: Rs 14 to start, then Rs 39 a km. Night: Rs 21 to start, then Rs 58.50 a km

a. In Poush the family used 9 units of water. How much is the water bill, with the sewerage charge? **[1]**

b. In the same month they used 72 units of electricity. Find the electricity bill. **[2]**

c. Bibek's uncle lands at the airport, 9 km from their home, at 10 o'clock at night. Bibek says, "At night the taxi costs one and a half times the day fare." Is he right for this ride? Show it. **[2]**

Question 5 — 5 marks

Rajkumar has a triangular field in Bara with sides of 130 ft, 140 ft and 150 ft. (1 kattha = 3,645 ft².)

a. How many dhur make 1 kattha? **[1]**

b. Find the semi-perimeter of the field. **[1]**

c. Find the area of the field in square feet, and in kattha and dhur. **[2]**

d. His neighbor's plot is 2 kattha 5 dhur. Whose land is bigger, and by how many square feet? **[1]**

Question 6 — 4 marks

Zeenat, a Grade 9 student in Nepalgunj, pours water into a cylindrical tin with an inner radius of 6 cm. Then she drops in a solid spherical stone of radius 3 cm, which sinks to the bottom and is covered by the water.

a. Write the formula for the surface area of a sphere. **[1]**

b. By how much does the water level in the tin rise? **[3]**

Question 7 — 4 marks

Salim builds a concrete ramp for wheelchairs at the door of a health post in Gorkha. It is a prism whose ends are right-angled triangles: the ramp rises 0.5 m over a level distance of 3 m, and it is 1.2 m wide.

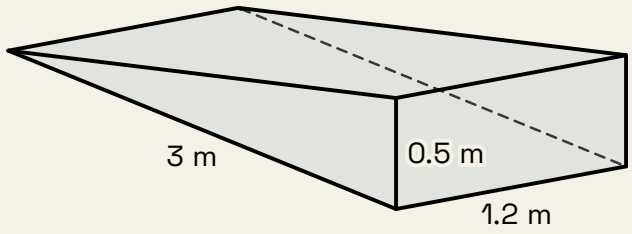


Figure 2

a. How much concrete does the ramp need? **[2]**

b. Concrete costs Rs 15,000 a cubic meter, and the health post has Rs 11,250 for the ramp. Is that enough? If not, how wide can the ramp be made with that money, with the same ends? **[2]**

Question 8 — 4 marks

The seats in a hall in Hetauda are in rows, each row having the same number more than the row in front of it. The 4th row has 26 seats and the 9th row has 41 seats.

a. What is the common difference of an arithmetic sequence? **[1]**

b. Find how many more seats each row has than the row in front. **[1]**

c. How many seats are in the first row, and how many in the 20th row? **[2]**

Question 9 — 7 marks

a. Write the factors of $a^4 + a^2b^2 + b^4$. **[1]**

b. Find the HCF of $27a^3 + 1$ and $81a^4 + 9a^2 + 1$. **[3]**

c. Simplify: $\left(\frac{x^a}{x^b}\right)^{\frac{1}{ab}} \times \left(\frac{x^b}{x^c}\right)^{\frac{1}{bc}} \times \left(\frac{x^c}{x^a}\right)^{\frac{1}{ca}}$ **[3]**

Question 10 — 4 marks

Sujata's mother is four times as old as Sujata. After 5 years, she will be three times as old as Sujata.

a. Find their present ages. **[2]**

b. After how many years will the mother be exactly twice as old as Sujata? After that, will she ever again be three times as old as Sujata? Give a reason. **[2]**

Question 11 — 5 marks

a. Verify experimentally that the sum of any two sides of a triangle is greater than the third side. Draw two triangles of different sizes. **[3]**

b. In the figure, $DE \parallel BC$, $AD = 4$ cm, $DB = 6$ cm and $DE = 5$ cm. Find the length of BC, with reasons. **[2]**

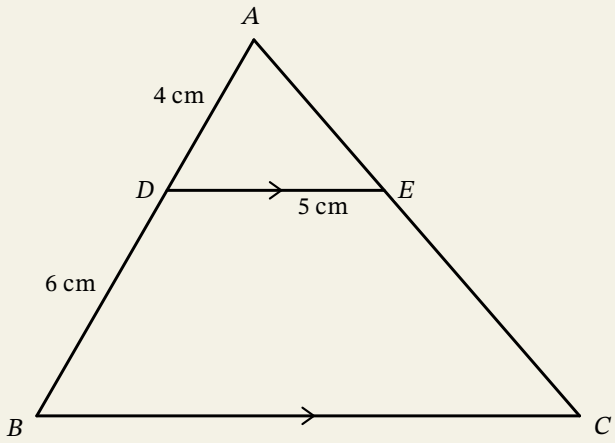


Figure 3 $DE \parallel BC$, $AD = 4$ cm, $DB = 6$ cm, $DE = 5$ cm.

Question 12 — 4 marks

In the parallelogram $ABCD$ in the figure, the diagonals AC and BD meet at O.

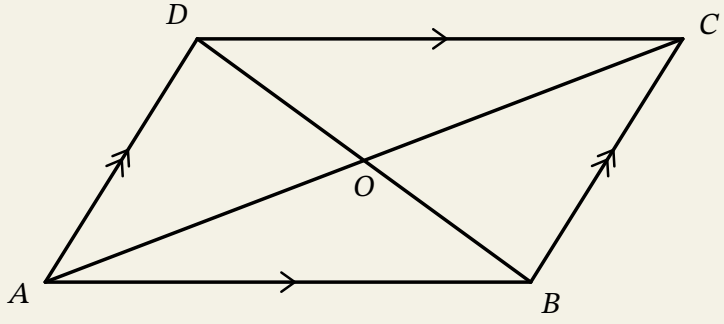


Figure 4

a. How are the diagonals of a parallelogram related? **[1]**

b. If $AO = (2x + 1)$ cm and $OC = (x + 4)$ cm, find x and the length of AC. **[1]**

c. Construct a trapezium $ABCD$ in which $AB \parallel DC$, $AB = 6.5$ cm, $BC = 4$ cm, $CD = 3.5$ cm and $\angle ABC = 60°$. **[2]**

Question 13 — 4 marks

The top of a round table in a hotel in Pokhara is a circle with center O. A straight strip of brass is fixed along the chord AB, 48 cm long, whose midpoint is M; $OM = 7$ cm.

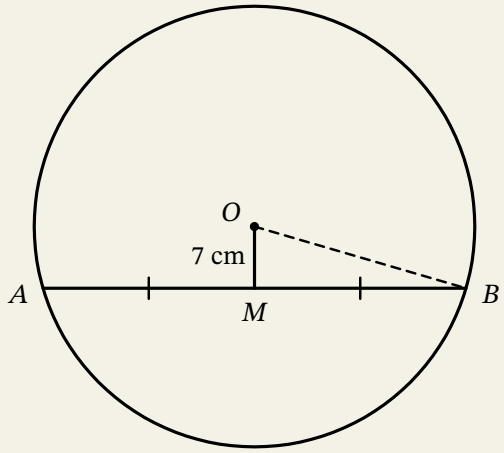


Figure 5

a. What is the size of $\angle OMA$? Write the theorem that gives it. **[1]**

b. Find the radius of the table top. **[2]**

c. A second brass strip CD, 14 cm long, is fixed along another chord. Which strip, AB or CD, is nearer the center? Give a reason. **[1]**

Question 14 — 5 marks

Hema, a sports teacher in Jumla, wrote down the shoe sizes of the 20 students of Grade 9 for a sports kit:

5, 6, 6, 7, 5, 8, 6, 7, 6, 4, 7, 6, 5, 6, 8, 7, 6, 5, 7, 6

a. In which form (series) are these data given? **[1]**

b. Make a frequency table of the data with tally marks. **[1]**

c. Find the mean shoe size. **[2]**

d. The shop will send most shoes in one size. Which measure of central tendency should Hema use to choose that size, and what is it? Give a reason. **[1]**

Question 15 — 6 marks

Before the planting season, Bishal, a farmer in Dang, tested 200 maize seeds from an agrovet shop. 170 of them germinated.

a. Write the formula for empirical probability. **[1]**

b. Find the empirical probability that a seed germinates. **[2]**

c. He sows 1,000 seeds from the same lot. About how many of them will not germinate? **[2]**

d. Can Bishal be sure that exactly 850 of the 1,000 seeds will germinate? Give a reason. **[1]**

Question 16 — 4 marks

At Dashain, Laxmi flies a kite (changa). Her string AK is 60 m long and makes an angle of 30∘ with the level line AB; $\angle ABK = 90°$.

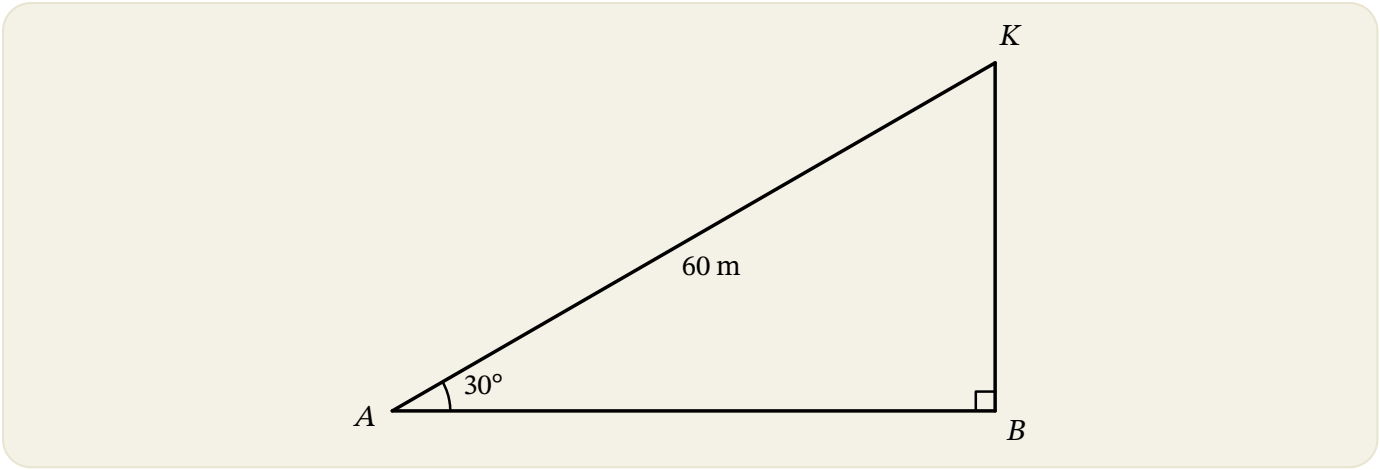


Figure 6

a. Write the value of $\sin 30^\circ$. **[1]**

b. Find the value of $\sin^2 60^\circ + \cos^2 30^\circ$. **[1]**

c. How high is the kite above Laxmi's hand? **[1]**

d. Her brother's kite string is also 60 m long, but his kite flies $30\sqrt{3}$ m above his hand. What angle does his string make with the level line? Give a reason. **[1]**