Final Exam Model Paper 1

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 18$\}$ is the universal set of $A = \{$even numbers$\}$, $B = \{$multiples of 3$\}$ and $C = \{$factors of 18$\}$.

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

b. Show the sets A, B and C in a Venn diagram. **[1]**

c. Prove by listing the elements: $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ **[3]**

d. What is the relation between $A \cap B$ and the set of multiples of 6 in U? Give a reason. **[1]**

Question 2 — 5 marks

Tilak teaches at a campus in Birendranagar. His monthly salary is Rs 85,000, and he gets 13 months' salary in a year, including the festival allowance. He pays a life insurance premium of Rs 30,000 a year, which the law allows to be taken off his income (up to Rs 40,000). 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. What is meant by taxable income? **[1]**

b. Find Tilak's yearly income. **[2]**

c. How much income tax does he pay in a year? **[2]**

Question 3 — 3 marks

Dolma sells handmade carpets from a factory in Jawalakhel, Lalitpur. She is paid no salary, only a commission of 4% on the carpets she sells.

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

b. In Baishakh she sold carpets worth Rs 3,60,000. How much commission did she earn? **[1]**

c. The factory offers her a new scheme instead: 2% on the first Rs 2,00,000 of sales in a month and 6% on the sales above that. For sales of Rs 3,60,000, which scheme pays her more, and by how much? **[1]**

Question 4 — 5 marks

Yubaraj's house in Pokhara has a 15 A electricity meter. NEA's tariff for a 15 A meter is:

Units in the month	Minimum charge	Energy charge per unit
0 to 20	Rs 50	Rs 4.00
21 to 30	Rs 75	Rs 6.50

Units in the month	Minimum charge	Energy charge per unit
31 to 50	Rs 75	Rs 8.00
51 to 100	Rs 100	Rs 9.50
101 to 250	Rs 125	Rs 9.50

The energy charge is worked out block by block: each rate only on the units inside its block. The minimum charge is for the block the month's units fall in.

a. The meter read 5238 last month and 5376 this month. How many units were used? **[1]**

b. Find this month's bill. **[2]**

c. Next month the family wants the bill to be no more than Rs 1,000. At most how many units can they use? **[2]**

Question 5 — 5 marks

A triangular plot of land in Tanahun has sides of 104 ft, 112 ft and 120 ft. (1 ropani = 5,476 ft².)

a. Write the formula for the area of a triangle whose three sides are a, b and c. **[1]**

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

c. Find the area of the plot. **[2]**

d. The seller says the plot is "a full ropani". Is he right? Give a reason. **[1]**

Question 6 — 4 marks

The cylindrical water tank on the roof of Lakpa's house in Biratnagar has an inner radius of 0.7 m. The area of its curved inner surface is 6.6 m².

a. Write the formula for the volume of a cylinder. **[1]**

b. How many liters of water does the full tank hold? If the family uses 330 liters a day, for how many days does a full tank last? **[3]**

Question 7 — 4 marks

The roof space of a cowshed (goth) in Dolakha, used to store hay, is a triangular prism. Its two ends are isosceles triangles with a base of 6 m and equal sides of 5 m, and it is 10 m long.

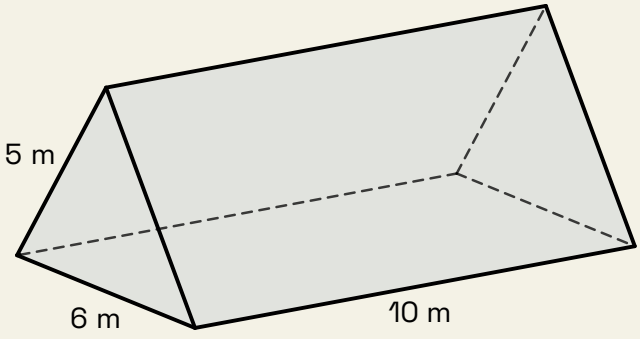


Figure 2

a. Find the total area of the two triangular ends. **[2]**

b. The farmer builds a new shed with ends of the same size, so that its roof space holds 300 m³ of hay. How long must the new roof space be, and how much longer is it than the old one? **[2]**

Question 8 — 4 marks

Rabina puts money in her khutruke (piggy bank) every week: Rs 50 in the first week, Rs 65 in the second, Rs 80 in the third, and so on, the amounts making an arithmetic sequence.

a. Write the formula for the general term of an arithmetic sequence. **[1]**

b. Find the common difference of the sequence. **[1]**

c. In which week does she put in Rs 350? **[2]**

Question 9 — 7 marks

a. Write $a^3 + b^3$ as a product of its factors. **[1]**

b. Find the HCF of $8a^3 + 27$ and $16a^4 + 36a^2 + 81$. **[3]**

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

Question 10 — 4 marks

Shristi's family travels from Kathmandu to Pokhara by tourist bus. For 3 adults and 2 children the tickets cost Rs 4,700; for 2 adults and 3 children they cost Rs 4,050.

a. Find the fare for an adult and for a child. **[2]**

b. Before Dashain the bus company raises the adult fare by 10% and the child fare by Rs 50. Shristi's uncle has Rs 4,000 for tickets for himself, his wife and their two children. Is it enough? Give a reason with a calculation. **[2]**

Question 11 — 5 marks

a. Verify experimentally that the perpendicular bisector of the base of an isosceles triangle passes through the vertex and bisects the vertical angle. Draw two isosceles triangles of different sizes. **[3]**

b. In the figure, $PQ = PR$ and the base QR is produced to S. If $\angle PRS = 115^\circ$, find the ratio $\angle QPR : \angle PQR$. **[2]**

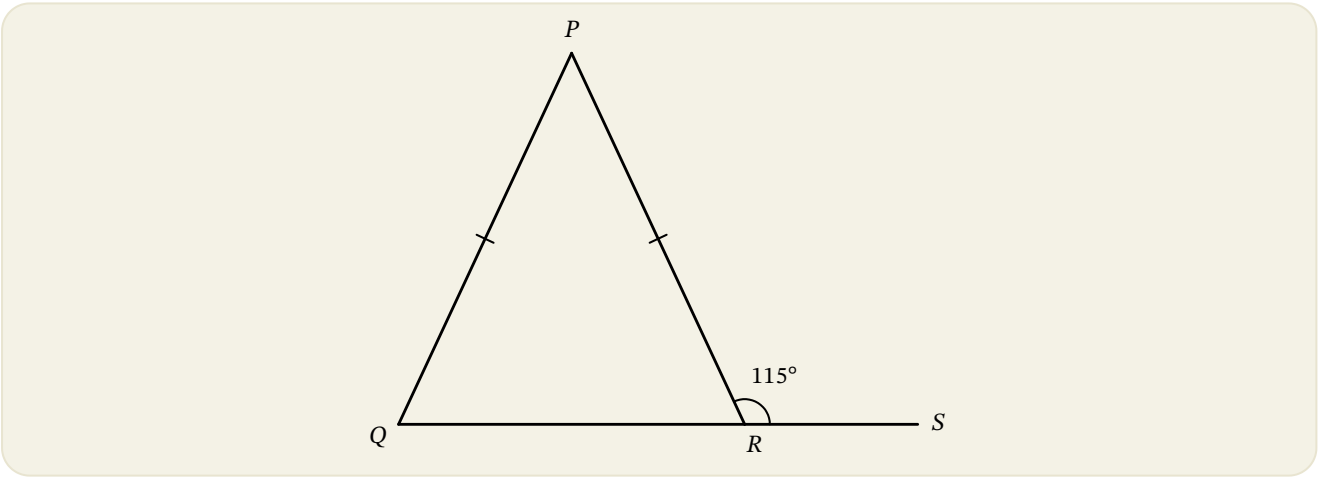


Figure 3 $PQ = PR$, and $\angle PRS = 115^\circ$.

Question 12 — 4 marks

In the parallelogram $ABCD$ in the figure, $\angle A = (3x + 10)^\circ$ and $\angle C = (5x - 30)^\circ$.

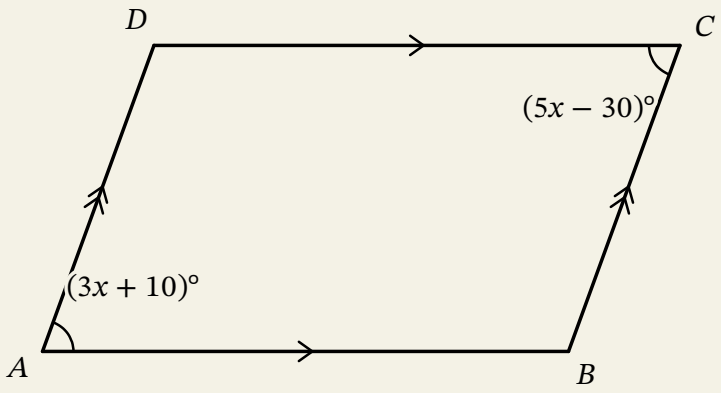


Figure 4

a. What is the relation between the opposite angles of a parallelogram? **[1]**

b. Find the value of x, and the size of $\angle B$. **[1]**

c. Construct a rhombus $PQRS$ with side $PQ = 5$ cm and $\angle QPS = 60°$. **[2]**

Question 13 — 4 marks

The figure shows the cross-section of a large water pipe of the Melamchi project, with center O and radius 25 cm. The water inside is shaded; its surface is the chord AB, 40 cm wide, and $OM \perp AB$.

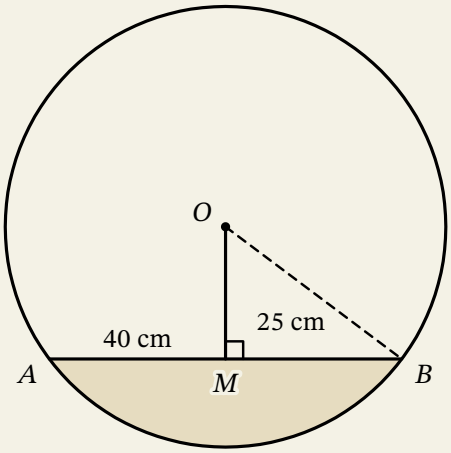


Figure 5

a. What is the relation between AM and MB? Write the theorem that gives it. **[1]**

b. Find the length of OM. **[2]**

c. How deep is the water in the pipe at its deepest point? Give a reason. **[1]**

Question 14 — 5 marks

The class teacher of Grade 9 at a school in Janakpur asked 30 students how many story books they read during the winter holidays:

Books read	0	1	2	3	4	5
Number of students	3	5	8	7	4	3

a. In which series is the data presented? **[1]**

b. Make a cumulative frequency table of the data. **[1]**

c. Find the mean number of books read. **[2]**

d. The librarian says, "At least half of these students read more books than the mean." Is she right? Give a reason. **[1]**

Question 15 — 6 marks

Nima's bag holds 20 beads of the same size: 5 red, 8 blue and 7 green. She shakes the bag and takes out one bead without looking.

a. What is the probability of a certain event? **[1]**

b. Find the probability that the bead is blue. **[2]**

c. Find the probability that the bead is not green. **[2]**

d. How many red beads must be added to the bag so that the probability of taking out a red bead becomes $\frac{1}{2}$? **[1]**

Question 16 — 4 marks

A ladder AC leans against a wall AB, with its foot C on level ground. $\angle ABC = 90^\circ$, and the ladder makes the angle θ with the ground.

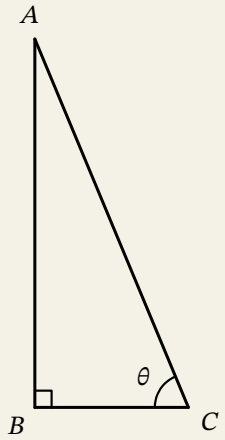


Figure 6

a. Which trigonometric ratio of θ does $\frac{BC}{AC}$ stand for? **[1]**

b. If $AB = 12$ ft and $BC = 5$ ft, find $\tan\theta$. **[1]**

c. Another ladder, 20 ft long, makes an angle of 60° with the ground. How high up the wall does it reach? **[1]**

d. If the length of the ladder is twice the distance of its foot from the wall, what is θ? Give a reason. **[1]**