

Questions
50 MCQs

Marks
150 (3 each)

Time
3 hours

Negative marking
–1 per wrong answer

Part	Section	Questions	Q. No.
Section 1	Verbal Ability	15	1 to 15
Section 2	Logical Reasoning	5	16 to 20
Section 3	Data Interpretation and Data Visualization	5	21 to 25
Section 4	Quantitative Aptitude	25	26 to 50

Instructions

1. The test has 50 multiple-choice questions: 15 on Verbal Ability, 5 on Logical Reasoning, 5 on Data Interpretation and Data Visualization, and 25 on Quantitative Aptitude.
2. Every question has four options and only one correct answer.
3. You score 3 marks for a correct answer, 0 for an unattempted question and –1 for a wrong answer.
4. Attempt the whole paper in one sitting of 3 hours, as in the computer-based test. Calculators, graph sheets and tables are not allowed.
5. Some questions are based on a passage, a set of clues or a data table. Read the whole set before answering.
6. The answer key and short solutions are at the end. Check them only after you finish.

This is an AglaSem practice paper written on the official PGDBA Admission Test pattern and syllabus (CBT: 50 MCQs, 150 marks, 3 hours, +3/–1). It is not an official paper of ISI Kolkata, IIT Kharagpur or IIM Calcutta, and its questions are original.

Verbal Ability

The passage below is followed by five questions. Choose the best answer to each question.

Imagine a screening test for a rare condition that affects one person in a thousand. The test is good: it correctly flags 99 per cent of people who have the condition, and wrongly flags only 2 per cent of those who do not. A person tests positive. How worried should she be? Most people, including many trained professionals, guess that she almost certainly has the condition. The arithmetic says otherwise. In a town of 100,000, about 100 people have the condition and the test catches 99 of them. But of the 99,900 who are healthy, 2 per cent, nearly 2,000, are flagged as well. Of roughly 2,100 positive results, fewer than one in twenty belongs to someone who is actually ill.

The error has a name: base-rate neglect. When we judge a single case, the vivid, specific evidence in front of us, the positive result, crowds out the dull background fact of how common the condition is to begin with. The same pattern appears in judgements about professions, crimes and machine failures alike. It is not that people cannot do the sum; it is that the question, as usually framed, does not invite them to.

That last point suggests a remedy. When the same problem is presented in natural frequencies ('out of 1,000 people, 1 has the condition...') rather than in percentages and conditional probabilities, far more people reach the right answer. The information is identical; only its packaging differs. Counting imagined people seems to come more easily to us than multiplying abstract chances.

The lesson matters well beyond medicine. A fraud-detection system that flags suspicious transactions, a filter that marks e-mails as spam and an algorithm that predicts which machines will fail all face the same trap whenever the event they hunt for is rare. Even a highly accurate detector will produce mostly false alarms if genuine cases are scarce enough. Those who design such systems must therefore ask not only 'How accurate is the test?' but also 'How rare is the thing we are looking for?', and those who receive the alarms deserve to be told the answer to both.

1. The primary purpose of the passage is to:
 - (A) prove that trained professionals are worse at arithmetic than ordinary people
 - (B) explain the methods banks use to design their systems for detecting fraud
 - (C) show that judging a single case requires knowing how common the event is to begin with
 - (D) argue that medical screening tests are usually inaccurate and should therefore be abandoned altogether
2. Suppose that in the passage's example the condition affected 1 person in 100 instead of 1 in 1,000, with the test unchanged. The share of positive results that belong to people who actually have the condition would then be closest to:

(A) nine in ten	(B) one in two
(C) one in twenty	(D) one in three
3. As used in the passage, "natural frequencies" refers to:
 - (A) the number of times a test is repeated on one person
 - (B) stating information as counts of cases out of a whole group
 - (C) percentages and conditional probabilities given together
 - (D) the rate at which a condition occurs naturally in animals
4. With which statement would the author most likely agree?
 - (A) Base-rate neglect occurs only in medical decisions
 - (B) Alarm systems for rare events should be designed to raise fewer false alarms than true ones in every case
 - (C) Psychologists have shown that people simply cannot do probability sums
 - (D) A detector's accuracy alone does not tell us how far to trust its alarms

5. The word "packaging", as used in the third paragraph, most nearly means:
- (A) the cost of collecting the information
 - (B) the way the information is presented
 - (C) the boxes in which test kits are sent
 - (D) the amount of information supplied

The passage below is followed by five questions. Choose the best answer to each question.

For much of the twentieth century, the standard story about shared resources was a gloomy one. A pasture open to all, the argument ran, will be overgrazed, because each herder gains the full benefit of adding one more animal while bearing only a small share of the damage. Multiply that reasoning across every herder and the pasture is ruined, even though no one wanted that outcome. The story was applied to fisheries, forests, groundwater and the atmosphere, and it seemed to leave only two cures: hand the resource to the state, or divide it into private plots.

Researchers who actually visited villages, irrigation systems and fishing grounds found a messier and more hopeful picture. In many places, communities had managed common resources for generations without either a distant government or private ownership; alpine meadows, village forests and irrigation networks were among the examples studied. These arrangements did not rely on goodwill alone. They had clear boundaries defining who could use the resource; rules suited to local conditions; ways for users to take part in changing the rules; monitors who were themselves accountable to the users; graduated penalties, mild for a first offence and harsher for repeated ones; and cheap, local ways of settling disputes.

None of this means that the gloomy story is wrong. Where users are strangers, where they cannot talk to one another, or where the resource is so vast that no group can watch over it, overuse remains a real danger. The point is rather that the outcome depends on institutions, and that institutions can be designed. The question 'state or market?' turned out to be too narrow; a third option, self-governance by the users themselves, had been working quietly all along.

The lesson has been taken up well beyond pastures and fisheries. Open-source software projects, shared databases and online communities wrestle with the same problems of free-riding and rule-making, and the most durable of them look surprisingly like the old irrigation societies.

6. According to the "standard story", a pasture open to all is overused because:
- (A) the state usually takes over shared land before it can be managed well
 - (B) each user gains fully from extra use but bears only part of the damage
 - (C) herders deliberately set out to ruin pastures shared with their rivals
 - (D) private owners always graze more animals than common users do
7. Which of the following was NOT described as a feature of the successful community arrangements?
- (A) Penalties that were equally severe for every offence
 - (B) Monitors who were accountable to the users
 - (C) Clear boundaries defining who could use the resource
 - (D) A role for users in changing the rules
8. The author's attitude towards the "gloomy story" is best described as:
- (A) indifference, since the author takes no position on it
 - (B) accepting that it holds under some conditions while rejecting it as a universal rule
 - (C) complete acceptance, since only the state or the market can protect a resource
 - (D) complete rejection, since the author shows that communities never overuse shared resources

9. According to the passage, which resource would be MOST at risk of overuse?
- (A) A vast ocean fishery used by fleets that never communicate with one another
 - (B) A village forest managed for generations by its own residents
 - (C) A mountain meadow with clear rules on who may graze cattle there
 - (D) An irrigation network whose users elect the officials who monitor it
10. The final paragraph of the passage serves mainly to:
- (A) summarise the case for dividing resources into private plots
 - (B) introduce new evidence suggesting that self-governance of resources usually fails in the end
 - (C) extend the argument to modern shared resources that are not natural
 - (D) describe the history of irrigation societies in detail
11. The four sentences (labelled 1, 2, 3 and 4) below, when properly sequenced, form a coherent paragraph. Choose the most coherent order.
1. As a result, the same bridge may be described as 'safe' by one engineer and 'risky' by another, without either of them being wrong.
2. Engineers rarely speak of a structure as simply safe or unsafe.
3. Instead, they estimate the probability that it will fail within a given period under the expected loads.
4. Whether that probability is acceptable, however, is a judgement that depends on what is at stake.
- (A) 2, 3, 1, 4
 - (B) 2, 4, 3, 1
 - (C) 2, 3, 4, 1
 - (D) 3, 2, 4, 1
12. The four sentences (labelled 1, 2, 3 and 4) below, when properly sequenced, form a coherent paragraph. Choose the most coherent order.
1. Yet sales of crisps and chocolate kept rising, while the new fruit counter went largely untouched.
2. From then on, they trusted the till receipts more than the questionnaires.
3. A retailer once surveyed its customers and found that most claimed to prefer healthy snacks.
4. The managers concluded that the survey had measured good intentions, not buying habits.
- (A) 3, 4, 1, 2
 - (B) 3, 1, 2, 4
 - (C) 3, 1, 4, 2
 - (D) 1, 3, 4, 2
13. The four sentences (labelled 1, 2, 3 and 4) below, when properly sequenced, form a coherent paragraph. Choose the most coherent order.
1. Bees, for instance, cannot see red, but they can see ultraviolet light, which is invisible to us.
2. A flower that looks dull to a gardener may therefore be a brightly marked landing strip for a bee.
3. Many flowers that look plain to human eyes carry ultraviolet patterns that point towards the nectar.
4. Insects and humans do not see the world in the same colours.
- (A) 4, 3, 1, 2
 - (B) 4, 1, 3, 2
 - (C) 3, 1, 4, 2
 - (D) 1, 4, 3, 2
14. Fill in the blank with the most suitable word.
- The committee's report was so _____ that even experts struggled to find a single clear recommendation in it.
- (A) convoluted
 - (B) concise
 - (C) comprehensible
 - (D) lucid
15. Which of the following sentences is grammatically correct?
- (A) Each of the analysts have submitted their reports on time.
 - (B) The figures that was released by the ministry last week shows a decline.
 - (C) Neither the manager nor the analysts was aware of the error.
 - (D) Neither the manager nor the analysts were aware of the error.

Logical Reasoning

The following information relates to all five questions on Logical Reasoning.

Five analysts, Asha, Bilal, Chen, Deepa and Eshan, each work for exactly one of five clients (Fintech, Grocery, Hospital, Insurance and Logistics) and each uses exactly one of five tools (Python, R, SQL, Excel and Tableau). No two analysts share a client or a tool.

1. Asha works for the Hospital client and uses neither Python, R nor Tableau.
2. The analyst for the Fintech client uses Python.
3. Chen uses SQL.
4. Deepa uses neither R nor Python.
5. Eshan works neither for the Fintech client nor for the Insurance client.
6. The analyst for the Grocery client uses R.
7. Chen does not work for the Insurance client.

16. Who works for the Insurance client?
(A) Chen (B) Eshan
(C) Deepa (D) Bilal
17. Which tool is used for the Logistics client?
(A) Tableau (B) SQL
(C) Excel (D) R
18. Which of the following pairs of analyst and tool is correctly matched?
(A) Chen – R (B) Deepa – SQL
(C) Eshan – R (D) Bilal – Excel
19. If clue 7 were removed, which of the following could no longer be determined with certainty?
(A) The client of Eshan
(B) The tool used by each of Bilal and Eshan
(C) The tool used by Asha
(D) The clients of Chen and Deepa
20. Which of the following statements is true?
(A) The analyst who uses Excel works for the Hospital client
(B) Chen works for the Grocery client
(C) The analyst for the Fintech client is Eshan, who uses Python
(D) The Tableau user works for the Logistics client

Section 3

Data Interpretation and Data Visualization

The table below shows the quarterly revenue (in ₹ crore) of a company's four product lines in one year. Answer the next three questions.

Product line	Q1	Q2	Q3	Q4
Alpha	40	45	50	65
Beta	60	55	50	45
Gamma	30	36	45	54
Delta	70	70	75	80

21. Which product line had the highest percentage growth in revenue from Q1 to Q4?
- (A) Beta (B) Delta
(C) Gamma (D) Alpha
22. The share of Delta in the company's total revenue for the year is closest to:
- (A) 37% (B) 28%
(C) 34% (D) 31%
23. Which of the following statements is true?
- (A) Gamma's revenue grew by the same percentage from Q1 to Q2 as from Q3 to Q4
(B) Total revenue grew by more than 10% in every quarter
(C) Beta's revenue fell by the same percentage in every quarter
(D) Alpha's revenue for the year was more than Beta's

A survey asked 500 customers of a store for their preferred mode of payment. The results by age group are given below. Answer the next two questions.

Age group	UPI	Card	Cash	Total
18–30	120	40	20	180
31–45	90	60	30	180
46–60	30	40	30	100
Above 60	5	10	25	40
Total	245	150	105	500

24. Of the customers who prefer cash, about what percentage are above 60 years of age?
- (A) 63% (B) 24%
(C) 5% (D) 10%
25. A customer is picked at random from those aged 31 to 60. What is the probability that this customer prefers UPI?
- (A) $\frac{1}{2}$ (B) $\frac{3}{7}$
(C) $\frac{12}{25}$ (D) $\frac{6}{25}$

Section 4

Quantitative Aptitude

26. In a survey of 60 students, 30 like cricket, 25 like football and 20 like hockey. 10 like both cricket and football, 8 like both football and hockey, 9 like both cricket and hockey, and 4 like all three. How many students like none of the three games?
- (A) 12 (B) 8
(C) 4 (D) 0
27. In how many ways can the letters of the word ANALYTICS be arranged so that the vowels A, A and I are always together?
- (A) 30240 (B) 5040
(C) 181440 (D) 15120
28. Machines A, B and C produce 50%, 30% and 20% of a factory's output, and 1%, 2% and 3% of their products respectively are defective. An item picked at random is found to be defective. The probability that it was made by machine A is:
- (A) $\frac{5}{17}$ (B) $\frac{1}{2}$
(C) $\frac{3}{17}$ (D) $\frac{6}{17}$
29. Three different numbers are chosen at random from $\{1, 2, \dots, 10\}$. The probability that the smallest of them is 3 is:
- (A) $\frac{21}{40}$ (B) $\frac{1}{10}$
(C) $\frac{3}{10}$ (D) $\frac{7}{40}$
30. The equation $x^2 + kx + 9 = 0$ has real and distinct roots if and only if:
- (A) $-6 < k < 6$ (B) $k > 6$ only
(C) $k \leq -6$ or $k \geq 6$ (D) $k < -6$ or $k > 6$
31. How many integers x satisfy both $(x - 2)(x - 7) < 0$ and $|x - 4| \leq 2$?
- (A) 6 (B) 3
(C) 4 (D) 5
32. For what value of k does the system $x + 2y = 3$ and $3x + ky = 9$ have infinitely many solutions?
- (A) 6 (B) -6
(C) 9 (D) 3
33. The term independent of x in the expansion of $(2x + \frac{1}{x^2})^9$ is:
- (A) 672 (B) 2688
(C) 84 (D) 5376
34. The sum of all three-digit natural numbers divisible by 7 is:
- (A) 70343 (B) 70336
(C) 69342 (D) 71435
35. The arithmetic mean and the harmonic mean of two positive numbers are 25 and 16. Their geometric mean is:
- (A) 20.5 (B) 18
(C) 22 (D) 20
36. If $A = \{[1, 1], [0, 1]\}$, then A^{10} equals:
- (A) $\{[1, 10], [0, 1]\}$ (B) $\{[1, 1024], [0, 1]\}$
(C) $\{[1, 1], [0, 1]\}$ (D) $\{[10, 10], [0, 10]\}$

37. The matrix $\begin{bmatrix} x & 2 \\ 3 & x - 1 \end{bmatrix}$ is singular for:
 (A) $x = 6$ or $x = -1$ (B) $x = -3$ or $x = 2$
 (C) $x = 2$ or $x = 3$ (D) $x = 3$ or $x = -2$
38. In triangle ABC, $AB = 6$ cm, $AC = 9$ cm and $BC = 10$ cm. The bisector of angle A meets BC at D. The length of BD is:
 (A) 4 cm (B) 6 cm
 (C) 5 cm (D) 3.6 cm
39. Two chords AB and CD of a circle intersect at a point P inside the circle. If $AP = 4$ cm, $PB = 6$ cm and $CP = 3$ cm, then PD is:
 (A) 6 cm (B) 2 cm
 (C) 4.5 cm (D) 8 cm
40. The equation of the line through (2, 3) that makes equal non-zero intercepts on the coordinate axes is:
 (A) $x + y = 5$ (B) $2x + 3y = 13$
 (C) $x - y + 1 = 0$ (D) $x + y = 6$
41. The length of the tangent drawn from the point (5, 1) to the circle $x^2 + y^2 + 6x - 4y - 3 = 0$ is:
 (A) 7 (B) 49
 (C) 5 (D) $\sqrt{29}$
42. The focus of the parabola $y^2 - 8x - 2y + 17 = 0$ is:
 (A) (4, 1) (B) (0, 1)
 (C) (2, 1) (D) (4, -1)
43. The length of the minor axis of an ellipse is equal to the distance between its foci. Its eccentricity is:
 (A) $1/3$ (B) $1/\sqrt{2}$
 (C) $\sqrt{3}/2$ (D) $1/2$
44. If $\sin \theta + \cos \theta = 7/5$, then $\sin 2\theta$ equals:
 (A) $49/25$ (B) $12/25$
 (C) $7/25$ (D) $24/25$
45. From the top of a building 60 m high, the angles of depression of the top and the bottom of a tower are 30° and 60° respectively. The height of the tower is:
 (A) 20 m (B) 40 m
 (C) 45 m (D) 30 m
46. In triangle ABC, the sides are $a = 7$, $b = 8$ and $c = 5$. The angle A is:
 (A) 60° (B) 120°
 (C) 90° (D) 45°
47. The value of $\lim_{x \rightarrow 0} (e^{3x} - 1 - 3x)/x^2$ is:
 (A) 0 (B) 3
 (C) $9/2$ (D) 9
48. The function $f(x) = ax + 1$ for $x \leq 2$ and $f(x) = x^2 - b$ for $x > 2$ is differentiable at $x = 2$. Then $a + b$ equals:
 (A) 9 (B) 4
 (C) -1 (D) -5
49. The shortest distance from the point (0, 3) to the parabola $y = x^2$ is:
 (A) $\sqrt{2}$ (B) $\sqrt{11}/2$
 (C) 3 (D) $\sqrt{3}$

50. The area of the region enclosed between the curves $y = x^2$ and $y = 2 - x^2$ is:
- (A) $\frac{4}{3}$ (B) $\frac{16}{3}$
(C) $\frac{8}{3}$ (D) 2

Answer Key

1	C	2	D	3	B	4	D	5	B	6	B	7	A	8	B	9	A	10	C
11	C	12	C	13	B	14	A	15	D	16	C	17	B	18	C	19	D	20	A
21	C	22	C	23	A	24	B	25	B	26	B	27	D	28	A	29	D	30	D
31	C	32	A	33	D	34	B	35	D	36	A	37	D	38	A	39	D	40	A
41	A	42	A	43	B	44	D	45	B	46	A	47	C	48	C	49	B	50	C

Solutions

Verbal Ability

1. (C) The passage builds from the screening example to the general rule that rare events produce mostly false alarms, so base rates must be considered. It calls the test 'good', so the second option is wrong.
2. (D) In 100,000 people, 1,000 are ill and 990 test positive; of 99,000 healthy people, 2% = 1,980 test positive. $990/(990 + 1,980) = 1/3$.
3. (B) The passage contrasts 'out of 1,000 people, 1 has the condition...' with percentages and conditional probabilities.
4. (D) The last paragraph says designers must ask both how accurate the test is and how rare the event is. The passage says people can do the sum but are not invited to by the framing.
5. (B) 'The information is identical; only its packaging differs' refers to frequencies versus percentages, i.e. presentation.
6. (B) The passage: each herder 'gains the full benefit of adding one more animal while bearing only a small share of the damage'.
7. (A) The passage lists 'graduated penalties, mild for a first offence and harsher for repeated ones', so equal penalties for every offence is not a feature.
8. (B) 'None of this means that the gloomy story is wrong... overuse remains a real danger' under some conditions, but the outcome 'depends on institutions'.
9. (A) The passage names strangers who cannot talk to one another and resources too vast to watch over as the conditions in which overuse remains a danger.
10. (C) It applies the same problems of free-riding and rule-making to open-source projects, shared databases and online communities.
11. (C) 2 states the idea, 3 ('Instead') gives the alternative, 4 ('that probability') adds that acceptability is a judgement, and 1 ('As a result') draws the consequence of that judgement.
12. (C) 3 sets up the survey, 1 ('Yet') contrasts actual sales, 4 gives the managers' conclusion and 2 ('From then on') states the result.
13. (B) 4 is the general opening, 1 ('for instance') illustrates it, 3 links ultraviolet sight to flower patterns and 2 ('therefore') concludes.
14. (A) Experts struggling to find a clear recommendation points to a confusing, needlessly complicated report: convoluted. Lucid, concise and comprehensible all suggest the opposite.
15. (D) With 'neither... nor', the verb agrees with the nearer subject ('analysts', plural): were. 'Each... has' and 'figures that were... show' are needed in the others.

Logical Reasoning

16. (C) From 1 and 3, Asha uses Excel; then 4 gives Deepa Tableau, so Bilal and Eshan use Python and R. Clues 2 and 6 put them on Fintech and Grocery, and 5 makes Eshan Grocery (R), Bilal Fintech (Python). Clue 7 then gives Chen Logistics and Deepa Insurance.
17. (B) Chen works for the Logistics client and uses SQL.

- 18. (C)** The full solution: Asha–Hospital–Excel, Bilal–Fintech–Python, Chen–Logistics–SQL, Deepa–Insurance–Tableau, Eshan–Grocery–R.
- 19. (D)** Clues 1 to 6 still fix every tool and the clients of Asha, Bilal and Eshan, but Chen and Deepa could then be on Insurance and Logistics either way.
- 20. (A)** Asha uses Excel and works for the Hospital client. Fintech is Bilal, Chen is on Logistics and the Tableau user (Deepa) is on Insurance.

Data Interpretation and Data Visualization

- 21. (C)** Growth Q1 to Q4: Alpha $25/40 = 62.5\%$, Beta -25% , Gamma $24/30 = 80\%$, Delta $10/70 \approx 14.3\%$.
- 22. (C)** Delta = $70 + 70 + 75 + 80 = 295$; total = $200 + 206 + 220 + 244 = 870$; $295/870 \approx 33.9\%$.
- 23. (A)** Gamma: $36/30 = 1.2$ and $54/45 = 1.2$, both 20% . Beta's falls are 8.3% , 9.1% , 10% ; Alpha $200 < \text{Beta } 210$; total growth was 3% , 6.8% and 10.9% .
- 24. (B)** Cash users = $20 + 30 + 30 + 25 = 105$, of whom 25 are above 60: $25/105 \approx 23.8\%$. (63% is the share of the above-60 group that prefers cash.)
- 25. (B)** Customers aged 31–60 = $180 + 100 = 280$, of whom $90 + 30 = 120$ prefer UPI: $120/280 = 3/7$.

Quantitative Aptitude

- 26. (B)** $n(C \cup F \cup H) = 30 + 25 + 20 - 10 - 8 - 9 + 4 = 52$, so $60 - 52 = 8$ like none.
- 27. (D)** Treat AAI as one block: 7 units arrange in $7! = 5040$ ways, and the block itself in $3!/2! = 3$ ways: 15120.
- 28. (A)** $P(\text{defective}) = 0.005 + 0.006 + 0.006 = 0.017$. By Bayes' theorem, $P(A | \text{defective}) = 0.005/0.017 = 5/17$.
- 29. (D)** 3 must be chosen and the other two must come from $\{4, \dots, 10\}$: ${}^7C_2/{}^{10}C_3 = 21/120 = 7/40$.
- 30. (D)** The discriminant $k^2 - 36$ must be positive, so $|k| > 6$. ($k = \pm 6$ gives equal roots.)
- 31. (C)** The first gives $2 < x < 7$, i.e. 3, 4, 5, 6; the second gives $2 \leq x \leq 6$. Common integers: 3, 4, 5, 6.
- 32. (A)** The second equation must be 3 times the first: $3x + 6y = 9$, so $k = 6$.
- 33. (D)** $T = {}^9C_r(2x)^r(9-r)(x^{-2})^r$ has power $9 - 3r = 0$, so $r = 3$: ${}^9C_3 \times 2^6 = 84 \times 64 = 5376$.
- 34. (B)** They run from 105 to 994: $n = (994 - 105)/7 + 1 = 128$ terms, sum = $128 \times (105 + 994)/2 = 64 \times 1099 = 70336$.
- 35. (D)** For two positive numbers $GM^2 = AM \times HM = 400$, so $GM = 20$. (The numbers are 40 and 10.)
- 36. (A)** $A^2 = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ and in general $A^n = \begin{bmatrix} 1 & n \\ 0 & 1 \end{bmatrix}$ (by induction), so $A^{10} = \begin{bmatrix} 1 & 10 \\ 0 & 1 \end{bmatrix}$.
- 37. (D)** Singular means the determinant is zero: $x(x - 1) - 6 = x^2 - x - 6 = (x - 3)(x + 2) = 0$.
- 38. (A)** By the angle bisector theorem $BD/DC = AB/AC = 6/9 = 2/3$, so $BD = 10 \times 2/5 = 4$ cm.
- 39. (D)** By the intersecting chords theorem $AP \times PB = CP \times PD$: $24 = 3 \times PD$, so $PD = 8$ cm.
- 40. (A)** $x/a + y/a = 1$ through (2, 3) gives $a = 5$: $x + y = 5$. $x - y + 1 = 0$ passes through the point but its intercepts are -1 and 1 .
- 41. (A)** Length = $\sqrt{S_1} = \sqrt{(25 + 1 + 30 - 4 - 3)} = \sqrt{49} = 7$.
- 42. (A)** $(y - 1)^2 = 8x - 16 = 8(x - 2)$: vertex (2, 1) and $4a = 8$, so $a = 2$ and the focus is $(2 + 2, 1) = (4, 1)$.
- 43. (B)** $2b = 2ae$ gives $b = ae$. Then $b^2 = a^2(1 - e^2)$ gives $e^2 = 1 - e^2$, so $e = 1/\sqrt{2}$.
- 44. (D)** Squaring: $1 + 2 \sin \theta \cos \theta = 49/25$, so $\sin 2\theta = 2 \sin \theta \cos \theta = 24/25$.
- 45. (B)** Distance between them = $60/\tan 60^\circ = 20\sqrt{3}$ m. The top of the tower is $20\sqrt{3} \times \tan 30^\circ = 20$ m below the roof, so the tower is $60 - 20 = 40$ m.
- 46. (A)** $\cos A = (b^2 + c^2 - a^2)/(2bc) = (64 + 25 - 49)/80 = 1/2$, so $A = 60^\circ$.
- 47. (C)** $e^{(3x)} = 1 + 3x + 9x^2/2 + \dots$, so the expression tends to $9/2$.
- 48. (C)** Equal derivatives: $a = 2x$ at $x = 2$, so $a = 4$. Continuity: $2a + 1 = 4 - b$ gives $9 = 4 - b$, so $b = -5$. $a + b = -1$.
- 49. (B)** $D^2 = x^2 + (x^2 - 3)^2$. With $u = x^2$, $D^2 = u + (u - 3)^2$, least at $u = 5/2$, giving $D^2 = 5/2 + 1/4 = 11/4$, so $D = \sqrt{11/2}$.
- 50. (C)** They meet at $x = \pm 1$. Area = $\int_{-1}^1 (2 - 2x^2) dx = [2x - 2x^3/3]_{-1}^1 = 2(2 - 2/3) = 8/3$.