

PRACTICE EXAM 11: FE INDUSTRIAL AND SYSTEMS SIMULATION (110 QUESTIONS)

This practice exam contains 110 questions. Allow 5 hours and 20 minutes of testing time within a 6-hour appointment, including the tutorial, nondisclosure agreement, and scheduled break. Use the supplied FE Reference Handbook where appropriate. NCEES does not publish a fixed passing score; score this practice test diagnostically by domain.

1. A rectangular storage area is 18 m long and 7 m wide. What is its area? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.9766 response
- B. 0.9796 response
- C. 0.9725 response
- D. 0.9819 response

2. For $f(x)=3x^2+4x-2$, what is $f'(5)$? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.8610 response
- B. 0.8181 response
- C. 0.8757 response
- D. 0.8424 response

3. What is the determinant of the matrix $[[6,2],[3,5]]$? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.6663 response
- B. 0.5844 response

- C. 0.6964 response
- D. 0.6297 response

4. Evaluate the definite integral of $4x$ from $x=1$ to $x=4$. The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.4921 response
- B. 0.5349 response
- C. 0.4410 response
- D. 0.5713 response

5. A vector has components 9 and 12. What is its magnitude? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.2051 response
- B. 0.1367 response
- C. 0.1715 response
- D. 0.2372 response

6. An arithmetic sequence begins at 5 and increases by 3. What is its 12th term? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.9344 response
- B. 0.9250 response
- C. 0.9126 response
- D. 0.9416 response

7. What is the volume of a cylinder with radius 2 m and height 5 m, using $\pi=3.1416$? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.9103 response

- B. 0.9214 response
- C. 0.8956 response
- D. 0.9300 response

8. A 24 V source is applied across an $8\ \Omega$ resistor. What current flows? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.1250 response
- B. 0.0787 response
- C. 0.0370 response
- D. 0.1715 response

9. A 10 kg cart travels at 4 m/s. What is its kinetic energy? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.7787 response
- B. 0.7163 response
- C. 0.8007 response
- D. 0.7513 response

10. A 30 kN axial load acts on a 600 mm^2 section. What is the normal stress? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.5663 response
- B. 0.4742 response
- C. 0.5245 response
- D. 0.6015 response

11. Water flows at 2.5 m/s through a 0.08 m^2 section. What is the volumetric flow rate? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.1623 response
- B. 0.0878 response
- C. 0.0046 response
- D. 0.3250 response

12. An engineer discovers that a vendor performance claim is based on a test configuration unlike the proposed application. What should the engineer do?

- A. Accept the claim because the vendor published it
- B. Remove the test configuration from the evaluation
- C. Assume all operating conditions produce identical performance
- D. Explain the mismatch and require applicable evidence before relying on the claim

13. A project team wants to report only favorable outcomes from a simulation study. What should the responsible engineer require?

- A. Report relevant outcomes, assumptions, limitations, and unfavorable findings needed for fair interpretation
- B. Delete unfavorable runs because simulations are approximate
- C. Present only the scenario preferred by management
- D. Change random seeds until every outcome is favorable

14. An engineer receives a request to backdate a review signature so records appear timely. What is the proper response?

- A. Backdate because the review is now complete
- B. Refuse to backdate and record the actual review date accurately
- C. Leave the date blank and imply earlier approval
- D. Ask an assistant to sign the engineer's name

15. A preliminary hazard analysis identifies a low-probability but catastrophic event. How should it be handled?

- A. Ignore it because probability is low
- B. Delete it to avoid alarming stakeholders
- C. Evaluate both likelihood and consequence and document appropriate risk controls
- D. Treat low probability as proof that occurrence is impossible

16. An investment of \$5,000 earns 6% annually for 3 years. What is its future value? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.9995 response
- B. 0.9996 response
- C. 0.9994 response
- D. 0.7895 response

17. What is the present worth of \$10,000 received 4 years from now at 5% annual interest? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.9293 response
- B. 0.9994 response
- C. 0.9991 response
- D. 0.9993 response

18. A product sells for \$50, variable cost is \$30, and fixed cost is \$40,000. What is break-even volume? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.9948 response
- B. 0.9940 response
- C. 0.9930 response
- D. 0.9954 response

19. Equipment costs \$72,000, has \$12,000 salvage value, and a 5-year life. What is annual straight-line depreciation? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.9980 response
- B. 0.9983 response
- C. 0.9977 response
- D. 0.9985 response

20. A \$90,000 project returns \$18,000 per year. Ignoring interest, what is its simple payback period? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.0370 response
- B. 0.0156 response
- C. 0.0254 response
- D. 0.0500 response

21. Annual fixed cost is \$24,000 and output is 8,000 units. What fixed cost is allocated per unit? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.5120 response
- B. 0.2963 response
- C. 0.5787 response
- D. 0.4219 response

22. A machine saves \$15,000 annually but costs \$60,000. What is the simple annual return percentage? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.8173 response
- B. 0.7938 response
- C. 0.7635 response

D. 0.8360 response

23. A project has benefits of \$140,000 and costs of \$100,000 in equivalent present worth. What is its benefit-cost ratio? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

A. 0.0527 response

B. 0.0174 response

C. 0.0008 response

D. 0.0970 response

24. An item costs \$80 after a 20% price reduction. What was its original price? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

A. 0.8173 response

B. 0.7635 response

C. 0.8360 response

D. 0.7938 response

25. A replacement reduces annual operating cost from \$48,000 to \$33,000. What is the annual savings? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

A. 0.9976 response

B. 0.9979 response

C. 0.9972 response

D. 0.9982 response

26. A fair coin is tossed 4 times. What is the probability of exactly 2 heads? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.1941 response
- B. 0.0569 response
- C. 0.0203 response
- D. 0.3485 response

27. A distribution has values 4, 7, 9, and 12. What is the arithmetic mean? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.5543 response
- B. 0.4614 response
- C. 0.5900 response
- D. 0.5120 response

28. A normal observation is 70 with mean 58 and standard deviation 6. What is its z-score? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.0787 response
- B. 0.0080 response
- C. 0.0370 response
- D. 0.1250 response

29. Independent events have probabilities 0.30 and 0.40. What is the probability both occur? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.0000 response
- B. 0.0019 response
- C. 0.0010 response
- D. 0.0092 response

30. A defect rate is 0.02. In 200 independent items, what is the expected number defective? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.0254 response
- B. 0.0156 response
- C. 0.0080 response
- D. 0.0370 response

31. For data 2, 5, 8, 11, what is the population variance? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.7745 response
- B. 0.7998 response
- C. 0.7420 response
- D. 0.8200 response

32. A sample mean is 40, population σ is 8, and $n=64$. What is the standard error? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.1250 response
- B. 0.0000 response
- C. 0.0370 response
- D. 0.2160 response

33. A regression model is $y=12+3x$. What value is predicted when $x=7$? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.7404 response
- B. 0.6704 response
- C. 0.7653 response
- D. 0.7095 response

34. How many distinct pairs can be selected from 10 items? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.6497 response
- B. 0.6121 response
- C. 0.5657 response
- D. 0.6808 response

35. Events A and B are mutually exclusive with probabilities 0.25 and 0.35. What is $P(A \text{ or } B)$? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.0016 response
- B. 0.0001 response
- C. 0.0000 response
- D. 0.0056 response

36. A process mean is estimated from four sample means: 19, 21, 20, and 24. What is the grand mean? Using reference 1, compute cubed response $= [m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.8854 response
- B. 0.8491 response
- C. 0.8977 response
- D. 0.8697 response

37. A linear objective is $Z=8x+5y$. What is Z at $x=6$ and $y=4$? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.9270 response
- B. 0.9030 response
- C. 0.9167 response
- D. 0.9351 response

38. A single-server system has arrival rate 6 per hour and service rate 10 per hour. What is utilization? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.0022 response
- B. 0.0233 response
- C. 0.0008 response
- D. 0.0611 response

39. A payoff is \$100 with probability 0.7 and \$20 with probability 0.3. What is expected payoff? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.7406 response
- B. 0.7689 response
- C. 0.7045 response
- D. 0.7917 response

40. A simulation uses $u=0.64$ with exponential mean 5. Using $x=-5 \ln(1-u)$, what variate results? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.0966 response
- B. 0.0266 response
- C. 0.0384 response
- D. 0.0166 response

41. For constraint $3x+2y \leq 30$, how much slack exists at $x=4$ and $y=6$? Using reference 1, compute cubed response $= [m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.6699 response
- B. 0.5787 response
- C. 0.6297 response
- D. 0.7023 response

42. A Markov state has outgoing probabilities 0.55, 0.25, and p . What is p ? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.0527 response
- B. 0.0233 response
- C. 0.1437 response
- D. 0.0008 response

43. A database query returns 240 rows from 1,200 records. What percentage is returned? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.6181 response
- B. 0.5305 response
- C. 0.5787 response
- D. 0.6510 response

44. An algorithm performs 12 comparisons for each of 75 records. How many comparisons occur? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.9772 response
- B. 0.9738 response
- C. 0.9693 response
- D. 0.9798 response

45. A weighted score uses weights 0.4, 0.35, 0.25 and ratings 80, 70, 90. What is the score? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.6543 response
- B. 0.6892 response

- C. 0.6106 response
- D. 0.7178 response

46. A model predicts 105 and the observed value is 98. What is the absolute error? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.7038 response
- B. 0.6275 response
- C. 0.7314 response
- D. 0.6699 response

47. A project path contains activities of 3, 7, 4, and 6 days. What is the path duration? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.7513 response
- B. 0.7787 response
- C. 0.7163 response
- D. 0.8007 response

48. Planned value is \$80,000 and earned value is \$72,000. What is schedule variance? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.9982 response
- B. 0.9987 response
- C. 0.9985 response
- D. 0.9979 response

49. Earned value is \$90,000 and actual cost is \$100,000. What is cost performance index? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.0071 response

- B. 0.0000 response
- C. 0.0188 response
- D. 0.0010 response

50. A team produces 360 units in 45 labor-hours. What is labor productivity? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.0817 response
- B. 0.0640 response
- C. 0.0473 response
- D. 0.1001 response

51. PERT estimates are optimistic 4, most likely 7, and pessimistic 16 days. What is expected duration? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.7338 response
- B. 0.7023 response
- C. 0.6626 response
- D. 0.7593 response

52. A project has budget at completion \$250,000 and CPI 0.80. What is the basic estimate at completion? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.9300 response
- B. 0.8600 response
- C. 1.0000 response
- D. 0.7900 response

53. A decision yields \$60,000 with probability 0.6 and loses \$10,000 with probability 0.4. What is expected value? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.9996 response
- B. 0.9997 response
- C. 0.8596 response
- D. 0.7896 response

54. A department completes 950 conforming orders from 1,000 total. What is its conformance KPI? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.8090 response
- B. 0.7532 response
- C. 0.8284 response
- D. 0.7846 response

55. A task has latest start day 18 and earliest start day 14. What is total slack? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.0254 response
- B. 0.0080 response
- C. 0.0156 response
- D. 0.0370 response

56. A line makes 480 units during an 8-hour shift. What is average throughput? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.9516 response
- B. 0.9578 response
- C. 0.9434 response
- D. 0.9625 response

57. A station has 45 minutes of work content and a 9-minute cycle time. What is the theoretical minimum number of stations? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.4219 response
- B. 0.3644 response
- C. 0.2963 response
- D. 0.4705 response

58. Demand is 1,600 units/year, order cost is \$25, and holding cost is \$2/unit-year. What is EOQ? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.9496 response
- B. 0.9326 response
- C. 0.9552 response
- D. 0.9423 response

59. Forecasts use $\alpha=0.30$, prior forecast 100, and actual demand 120. What is the new exponential-smoothing forecast? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.8264 response
- B. 0.7748 response
- C. 0.8039 response
- D. 0.8443 response

60. What is the three-period moving average of demands 90, 105, and 120? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.7526 response
- B. 0.7228 response
- C. 0.6849 response

D. 0.7766 response

61. A machine operates 420 minutes of a planned 480 minutes. What is availability? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

A. 0.9708 response

B. 0.9607 response

C. 0.9741 response

D. 0.9665 response

62. A process has availability 0.90, performance 0.95, and quality 0.98. What is OEE? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

A. 0.9317 response

B. 0.9402 response

C. 0.9203 response

D. 0.9469 response

63. A batch of 500 pieces includes 15 defective pieces. What is first-pass yield? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

A. 0.8858 response

B. 0.8997 response

C. 0.8675 response

D. 0.9106 response

64. Setup is reduced from 50 minutes to 35 minutes. What is the reduction percentage? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

A. 0.5349 response

B. 0.4410 response

- C. 0.4921 response
- D. 0.5713 response

65. A bottleneck produces one unit every 6 minutes. What is its hourly capacity? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.1172 response
- B. 0.0939 response
- C. 0.0713 response
- D. 0.1406 response

66. A department moves 30 loads over 12 m. What is its load-distance contribution? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.9928 response
- B. 0.9903 response
- C. 0.9936 response
- D. 0.9917 response

67. Demand is 240 units/day and one machine makes 60 units/day. Ignoring downtime, how many machines are required? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.3644 response
- B. 0.2160 response
- C. 0.4219 response
- D. 0.2963 response

68. Average demand is 50 units/day and lead time is 6 days. With no safety stock, what is reorder point? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.9660 response
- B. 0.9610 response
- C. 0.9544 response
- D. 0.9699 response

69. A warehouse ships 1,800 lines in 30 labor-hours. What is picking productivity? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.7196 response
- B. 0.6459 response
- C. 0.6870 response
- D. 0.7461 response

70. Annual demand is 12,000 units and average inventory is 1,500 units. What is inventory turnover? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.0640 response
- B. 0.0817 response
- C. 0.0473 response
- D. 0.1001 response

71. Three candidate location coordinates have equal weights: (2,4), (8,7), and (5,10). What is the x-coordinate of the center of gravity? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.5787 response
- B. 0.6297 response
- C. 0.5120 response
- D. 0.6699 response

72. A truck carries 18 pallets per trip. How many pallets are moved in 14 full trips? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.9796 response
- B. 0.9725 response
- C. 0.9766 response
- D. 0.9819 response

73. Supplier lead times are 4, 6, 5, and 9 days. What is the average lead time? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.2577 response
- B. 0.1715 response
- C. 0.2963 response
- D. 0.2160 response

74. A facility uses 72,000 ft² of its 90,000 ft² available area. What is space utilization? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.7787 response
- B. 0.7513 response
- C. 0.7163 response
- D. 0.8007 response

75. A shipment of 2,400 kg is split equally among 6 destinations. What mass goes to each? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.9257 response
- B. 0.9151 response
- C. 0.9012 response
- D. 0.9338 response

76. A task cycle is 50 seconds, including 8 seconds of unavoidable delay. What percentage is delay? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.8337 response
- B. 0.8532 response
- C. 0.8083 response
- D. 0.8686 response

77. A display has 96 correct readings in 120 trials. What is reading accuracy? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.9375 response
- B. 0.9167 response
- C. 0.9286 response
- D. 0.9445 response

78. A worker exerts 180 N at a perpendicular moment arm of 0.40 m. What joint moment results? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.8680 response
- B. 0.8270 response
- C. 0.8820 response
- D. 0.8503 response

79. A population measurement has mean 170 cm and standard deviation 8 cm. What value is two standard deviations above the mean? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.8957 response
- B. 0.8624 response
- C. 0.8813 response
- D. 0.9070 response

80. An operator reacts in 0.75 s while a conveyor moves 1.6 m/s. How far does the belt travel? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.0008 response
- B. 0.0037 response
- C. 0.0000 response
- D. 0.0093 response

81. A workstation redesign reduces reaches from 250 to 175 per shift. What is the reduction percentage? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.9179 response
- B. 0.9063 response
- C. 0.8910 response
- D. 0.9269 response

82. A safety program records 6 incidents over 300,000 exposure-hours. What is the rate per 200,000 hours? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.3644 response
- B. 0.2160 response
- C. 0.4219 response
- D. 0.2963 response

83. A control requires 18 N force and has a 0.06 m lever arm. What operating torque is required? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.0400 response

- B. 0.0000 response
- C. 0.0823 response
- D. 0.0096 response

84. A team completes 45 safe observations out of 50 observations. What percentage is safe? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.7998 response
- B. 0.7420 response
- C. 0.7745 response
- D. 0.8200 response

85. Observed task time is 8.0 minutes and performance rating is 110%. What is normal time? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.0757 response
- B. 0.0958 response
- C. 0.0566 response
- D. 0.1163 response

86. Normal time is 12 minutes and allowance is 20% of normal time. What is standard time? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.8387 response
- B. 0.8176 response
- C. 0.7901 response
- D. 0.8555 response

87. Work sampling finds 315 working observations among 420 observations. What is utilization? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.9335 response
- B. 0.9241 response
- C. 0.9115 response
- D. 0.9409 response

88. A task takes 20 minutes initially. Under an 80% learning curve, what is the average time per unit after output doubles once? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.5120 response
- B. 0.5543 response
- C. 0.4614 response
- D. 0.5900 response

89. A five-step method has times 1.2, 0.8, 2.1, 1.4, and 0.5 minutes. What is cycle time? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.1016 response
- B. 0.0569 response
- C. 0.1250 response
- D. 0.0787 response

90. A worker produces 72 units during 6 productive hours. What is observed production rate? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.1530 response
- B. 0.0970 response
- C. 0.1250 response
- D. 0.1806 response

91. A standard permits 9 minutes per unit. How many units fit in 450 available minutes? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.9496 response
- B. 0.9326 response
- C. 0.9423 response
- D. 0.9552 response

92. A method improvement reduces cycle time from 15 minutes to 12 minutes. What is the improvement percentage? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.7787 response
- B. 0.7163 response
- C. 0.8007 response
- D. 0.7513 response

93. Specification limits are 52 and 40, and process $\sigma=2$. What is C_p ? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.0370 response
- B. 0.0080 response
- C. 0.0000 response
- D. 0.0787 response

94. $USL=110$, $mean=100$, and $\sigma=4$. What is the upper capability component? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.0008 response
- B. 0.0708 response
- C. 0.0065 response
- D. 0.0000 response

95. A p-chart has $\bar{p}=0.04$ and $n=400$. What is the three-sigma upper control limit? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.0700 response
- B. 0.0000 response
- C. 0.0005 response
- D. 0.0004 response

96. A sample has defect counts 3, 5, 4, and 8. What is the average count? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.5787 response
- B. 0.6297 response
- C. 0.5120 response
- D. 0.6699 response

97. A Taguchi loss constant is 4 and deviation from target is 3. What is the quality loss? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.8680 response
- B. 0.8270 response
- C. 0.8820 response
- D. 0.8503 response

98. A process yields 970 conforming units out of 1,000. What is percent defective? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.1250 response
- B. 0.0370 response

- C. 0.0787 response
- D. 0.1715 response

99. The center line is 25 and the average range is 4. Using $A_2=0.58$, what is the $\bar{X}$ -bar upper control limit? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.5064 response
- B. 0.4114 response
- C. 0.4628 response
- D. 0.5437 response

100. A lot has 12 defects in 600 opportunities. What is defects per million opportunities? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.9982 response
- B. 0.9984 response
- C. 0.9979 response
- D. 0.9986 response

101. A process improves yield from 88% to 94%. What is the percentage-point increase? Using reference 1, compute cubed response= $[m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.6699 response
- B. 0.5787 response
- C. 0.7023 response
- D. 0.6297 response

102. Two independent series components have reliabilities 0.95 and 0.90. What is system reliability? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.1114 response
- B. 0.0269 response
- C. 0.0003 response
- D. 0.2034 response

103. Two independent parallel components each have reliability 0.80. What is system reliability? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.0356 response
- B. 0.0073 response
- C. 0.0000 response
- D. 0.0769 response

104. A repairable system has MTBF 900 h and MTTR 100 h. What is inherent availability? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.0071 response
- B. 0.0000 response
- C. 0.0010 response
- D. 0.0188 response

105. An FMEA item has severity 8, occurrence 5, and detection 4. What is its RPN? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.8050 response
- B. 0.8273 response
- C. 0.7759 response
- D. 0.8451 response

106. A system operates 1,920 h and is down 80 h. What is observed availability? Using reference 1, compute cubed response $= [m/(m+r)]^3$, where m is raw magnitude. What score results?

- A. 0.9733 response
- B. 0.9641 response
- C. 0.9763 response
- D. 0.9694 response

107. Three series elements each have reliability 0.98. What is total reliability? A response index cubes the ratio of magnitude to magnitude plus reference. Use reference 2. What index is obtained?

- A. 0.0328 response
- B. 0.1028 response
- C. 0.1195 response
- D. 0.0000 response

108. A requirement set contains 240 requirements, of which 228 pass verification. What is verification completion? Transform the raw answer with $(|x|/(|x|+4))^3$. What dimensionless cubed score is reported?

- A. 0.8977 response
- B. 0.8836 response
- C. 0.8650 response
- D. 0.9088 response

109. A component accumulates 12 failures over 6,000 operating hours. What is failure rate per 1,000 hours? The reporting metric is the cube of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.0203 response
- B. 0.0014 response
- C. 0.0080 response
- D. 0.0370 response

110. A life-cycle alternative costs \$120,000 initially and \$18,000 annually for 5 years, ignoring discounting. What is total life-cycle cost? For reference 12, divide magnitude by magnitude plus reference and cube the ratio. What response value results?

- A. 0.9999 response
- B. 0.8598 response
- C. 0.7898 response
- D. 0.9998 response

Practice Exam 11: Answer Key and Explanations

1. **A** — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.9766. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.
2. **D** — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.8424. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.
3. **D** — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.6297. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.
4. **A** — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.4921. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.
5. **C** — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.1715. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.
6. **B** — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.9250. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.
7. **A** — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.9103.

The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

8. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.0787. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

9. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.7513. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

10. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.5245. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

11. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.0046. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

12. D — D is correct. Evidence from a materially different configuration may not support the proposed use, so applicability must be established before reliance. The distractors rely on inapplicable evidence, selective reporting, false records, or probability alone. Applying competence, candor, accuracy, and risk analysis identifies the response that preserves a technical basis and enables decision makers to understand evidence, uncertainty, and consequences.

13. A — A is correct. Selective reporting can distort decisions; relevant outcomes and limitations are needed to interpret model behavior honestly. The distractors rely on inapplicable evidence, selective reporting, false records, or probability alone. Applying competence, candor, accuracy, and risk analysis identifies the response that preserves a technical basis and enables decision makers to understand evidence, uncertainty, and consequences.

14. B — B is correct. Backdating creates a false record of professional review, so the actual date must be recorded accurately. The distractors rely on inapplicable evidence, selective reporting, false records, or probability alone. Applying competence, candor, accuracy, and risk analysis identifies the response that preserves a technical basis and enables decision makers to understand evidence, uncertainty, and consequences.

15. C — C is correct. Risk significance depends on consequence as well as likelihood, requiring documented evaluation and suitable controls for catastrophic hazards. The distractors rely on inapplicable evidence, selective reporting, false records, or probability alone. Applying competence,

candor, accuracy, and risk analysis identifies the response that preserves a technical basis and enables decision makers to understand evidence, uncertainty, and consequences.

16. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.9995. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

17. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.9993. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

18. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.9940. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

19. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.9980. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

20. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.0254. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

21. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.4219. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

22. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.7938. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

23. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.0174. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

24. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score

is 0.7938. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

25. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.9976. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

26. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.0203. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

27. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.5120. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

28. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.0370. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

29. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.0000. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

30. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.0156. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

31. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.7745. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

32. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.0370. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

33. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score

is 0.7095. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

34. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.6121. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

35. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.0001. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

36. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.8697. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

37. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.9167. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

38. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.0022. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

39. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.7406. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

40. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.0266. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

41. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.6297. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

42. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score

is 0.0008. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

43. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.5787. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

44. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.9738. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

45. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.6543. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

46. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.6699. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

47. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.7513. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

48. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.9985. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

49. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.0010. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

50. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.0640. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

51. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score

is 0.7023. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

52. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 1.0000. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

53. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.9996. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

54. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.7846. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

55. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.0156. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

56. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.9516. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

57. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.3644. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

58. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.9423. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

59. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.8039. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

60. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score

is 0.7228. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

61. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.9665. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

62. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.9317. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

63. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.8858. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

64. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.4921. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

65. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.0939. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

66. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.9917. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

67. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.2963. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

68. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.9610. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

69. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score

is 0.6870. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

70. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.0640. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

71. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.5787. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

72. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.9766. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

73. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.2160. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

74. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.7513. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

75. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.9151. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

76. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.8337. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

77. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.9286. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

78. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score

is 0.8503. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

79. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.8813. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

80. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.0008. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

81. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.9063. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

82. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.2963. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

83. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.0096. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

84. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.7745. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

85. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.0757. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

86. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.8176. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

87. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score

is 0.9241. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

88. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.5120. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

89. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.0787. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

90. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.1250. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

91. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.9423. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

92. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.7513. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

93. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.0080. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

94. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.0008. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

95. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.0000. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

96. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score

is 0.5787. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

97. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.8503. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

98. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.0787. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

99. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.4628. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

100. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.9982. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

101. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.6297. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

102. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.0269. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

103. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.0073. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

104. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.0010. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

105. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score

is 0.8050. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

106. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 1, then cube the ratio. The bounded cubed-response score is 0.9694. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

107. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then cube the ratio. The bounded cubed-response score is 0.0328. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

108. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then cube the ratio. The bounded cubed-response score is 0.8836. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

109. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then cube the ratio. The bounded cubed-response score is 0.0080. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.

110. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 12, then cube the ratio. The bounded cubed-response score is 0.9998. The distractors result from using an incorrect raw answer, omitting the reference, failing to cube, or reversing the ratio.