

SAMPLE EXAM TWO QUESTIONS

Below are 84 sample questions to aid in your preparation for exam one. The items selected reflect the wide variety and levels of difficulty of questions typically encountered on exams. The exam will have between 23 and 33 questions. The number of items included here represents roughly the amount needed for four exams. For multiple choice items, after completing a question, choose the answer choice that best completes the statement or answers the question. For hand graded items, circle your final answer after showing all work. Finally, 20% of the exam will be hand graded.

1. $\sqrt[3]{125zy^4} - 7y\sqrt[3]{zy} =$

(a) $-2y\sqrt[3]{zy}$

(b) $-2zy$

(c) $12y\sqrt[3]{zy}$

(d) $2y\sqrt[3]{zy}$

(e) $5(y\sqrt[3]{5zy} - y\sqrt[3]{zy})$

2. $\sqrt[3]{16x^4y} - 3x\sqrt[3]{2xy} + 5\sqrt[3]{-2xy^4} =$

(a) $5x\sqrt[3]{2xy} - 5y\sqrt[3]{2xy}$

(b) $5\sqrt[3]{2xy} - 5\sqrt[3]{2xy}$

(c) $\sqrt[3]{2xy}(x - 5y)$

(d) $-x\sqrt[3]{2xy} + 5\sqrt[3]{2xy}$

(e) $-\sqrt[3]{2xy}(x + 5y)$

3. $6x^{\frac{1}{2}}(2x + 3) + x^{\frac{3}{2}} \cdot 8 =$

(a) $x^{\frac{3}{2}} + 18x^{\frac{1}{2}}$

(b) $x^{\frac{1}{2}}(10x + 6)$

(c) $x^{-\frac{1}{2}}(10x + 6)$

(d) $2x^{\frac{1}{2}}(10x + 9)$

(e) $2x^{\frac{1}{2}}(13x + 9)$

4. $qz^{-\frac{1}{2}} - 3z^{\frac{1}{2}} =$

(a) $\frac{-3z + q}{z^{\frac{1}{2}}}$

(b) $\frac{-q - 3}{z^{\frac{1}{2}}}$

(c) $-\frac{q}{z^{\frac{1}{2}}}$

(d) $\frac{3}{\sqrt{z}}$

(e) $-\frac{q + 3}{\sqrt{z}}$

5. Factor $6(6x + 1)^{\frac{1}{3}}(4x - 3)^{\frac{3}{2}} - 6(6x + 1)^{\frac{4}{3}}(4x - 3)^{\frac{1}{2}}$.

$$6. \frac{y^{\frac{1}{2}} + py^{-\frac{1}{2}}}{y} =$$

$$(a) \frac{y+p}{y^{\frac{3}{2}}}$$

$$(b) y^{\frac{1}{2}}(1+p)$$

$$(c) \frac{2p}{y^{\frac{3}{2}}}$$

$$(d) \frac{-2p}{y^{\frac{3}{2}}}$$

$$(e) \frac{1+p}{y^{\frac{1}{2}}}$$

$$7. 2(3x-5) \cdot 3(2x+1)^3 + 3(3x-5)^2 \cdot 2(2x+1)^2 =$$

$$(a) 6(3x-5)(2x+1)^2$$

$$(b) 2 \cdot 3 \cdot (3x-5)(2x+1)^2(5x-4)$$

$$(c) 6(8x^3+1)(3x-5)$$

$$(d) 2 \cdot 3(3x-5)^2(2x+1)$$

$$(e) 3 \cdot 2(3x-5)^2(2x+1)^2$$

$$8. \frac{(9-x^2)^{\frac{1}{2}} + x^2(9-x^2)^{-\frac{1}{2}}}{9-x^2} =$$

$$(a) \frac{2x^2}{(9-x^2)^{\frac{3}{2}}}$$

$$(b) \frac{x^2}{(9-x^2)^{\frac{1}{2}}}$$

$$(c) \frac{9+2x^2}{(9-x^2)^{\frac{3}{2}}}$$

$$(d) \frac{9}{(9-x^2)^{\frac{3}{2}}}$$

$$(e) \frac{9-2x^2}{(9-x^2)^{\frac{3}{2}}}$$

$$9. \frac{(y^2+1)^{\frac{1}{2}} - y^2 \cdot \frac{1}{2} \cdot (y^2+1)^{-\frac{1}{2}}}{y^2+1} =$$

$$(a) \frac{y^2-2}{2(y^2+1)^{\frac{3}{2}}}$$

$$(b) \frac{4y^2+2}{2(y^2+1)^{\frac{3}{2}}}$$

$$(c) \frac{y^2+2}{2(y^2+1)^{\frac{3}{2}}}$$

$$(d) \frac{y^2+2}{2(y^2+1)}$$

(e) $\frac{-y^2 + 2}{2(y^2 + 1)}$

10. $\frac{\sqrt{x^2 + 1} + x \cdot \frac{2x}{2\sqrt{x^2 + 1}}}{x^2 + 1} =$

(a) $\frac{1}{(x^2 + 1)^{\frac{3}{2}}}$

(b) $\frac{x^2}{x^2 + 1}$

(c) $\frac{-2x^2 + 1}{\sqrt{x^2 + 1}}$

(d) $\frac{\sqrt{x^2 + 1}}{x^2 + 1}$

(e) $\frac{2x^2 + 1}{(x^2 + 1)^{\frac{3}{2}}}$

11. $\frac{\frac{1}{2\sqrt{2z}} \cdot \sqrt{z+1} - \frac{\sqrt{2z}}{2\sqrt{z+1}}}{z+1} =$

(a) $\frac{1-z}{2\sqrt{2z}\sqrt{z+1} \cdot (z+1)}$

(b) $\frac{-1-z}{2\sqrt{2z}\sqrt{z+1}}$

(c) $\frac{z+1}{2\sqrt{2z}\sqrt{z+1}}$

(d) $\frac{z-1}{2\sqrt{2z}\sqrt{z+1} \cdot (z+1)}$

(e) $\frac{1-z}{\sqrt{2z}\sqrt{z+1} \cdot (z+1)}$

12. For $x > 0$, $\frac{1+x}{2x^{\frac{1}{2}}} + x^{\frac{1}{2}} =$

(a) $\frac{3x-1}{2x^{\frac{1}{2}}}$

(b) $\frac{3x+1}{2x^{\frac{1}{2}}}$

(c) $\frac{2x+1}{2x^{\frac{1}{2}}}$

(d) $-\frac{3x+1}{2x^{\frac{1}{2}}}$

(e) $\frac{2x-1}{2x^{\frac{1}{2}}}$

13. For $x > -1$, $\frac{x}{(1+x)^{\frac{1}{2}}} - 2(1+x)^{\frac{1}{2}} =$

(a) $-\frac{x}{(1+x)^{\frac{1}{2}}}$

(b) $\frac{2}{\sqrt{1+x}}$

(c) $x^2 - \sqrt{1+x}$

(d) $-\frac{x+2}{\sqrt{1+x}}$

(e) $\frac{x}{(1+x)^{\frac{1}{2}}}$

14. $\frac{x^2}{\sqrt{1-x^2}} - \sqrt{1-x^2} =$

(a) $\frac{2x^2-1}{\sqrt{1-x^2}}$

(b) $-\frac{1}{\sqrt{1-x^2}}$

(c) $-\sqrt{1-x^2}$

(d) $\frac{1}{\sqrt{1-x^2}}$

(e) $x^2 - \sqrt{1-x^2}$

15. $(\sqrt{5} \cdot \sqrt[3]{9})^2 =$

(a) $5\sqrt[6]{9}$

(b) $3\sqrt{5}$

(c) $5\sqrt[5]{9}$

(d) $15\sqrt[3]{3}$

(e) $\sqrt[4]{5}\sqrt[6]{9}$

16. $\sqrt[4]{x^{12}y^8} =$

(a) x^3y^2

(b) $x^{48}y^2$

(c) $x^{16}y^{12}$

(d) $|x|^3y^2$

(e) x^4y^2

17. $(\sqrt[3]{4} \cdot \sqrt{7})^2 =$
- (a) $7\sqrt[6]{4}$
 - (b) $7\sqrt[5]{4}$
 - (c) $\sqrt[6]{4}\sqrt[4]{7}$
 - (d) $2\sqrt{7}$
 - (e) $14\sqrt[3]{2}$
18. Jackie, by herself, can paint an apartment in 10 hours. If her sister Kathy helps her, they can do the same job together in 6 hours. If Jackie lets Kathy work alone, how long will it take Kathy to paint the apartment?
- (a) 48 hours
 - (b) 4 hour
 - (c) $\frac{28}{3}$ hours
 - (d) 15 hours
 - (e) 12 hours
19. A motor boat heads upstream a distance of 24 miles on a river whose current is 3 miles per hour. The trip up and back takes 6 hours. Assuming that the motor boat maintained a constant speed relative to the water, what was its speed?
- (a) 5 m.p.h.
 - (b) $\sqrt{5}$ m.p.h.
 - (c) 8 m.p.h
 - (d) $\frac{7}{3}$ m.p.h.
 - (e) 9 m.p.h.
20. A laboratory has 90 cubic centimeters of a solution that is 15% HCl acid. How many cubic centimeters of a 40% solution of HCl acid should be mixed with the 90 cubic centimeters of 15% solution to obtain a solution of 25% HCl?
- (a) 60
 - (b) 95
 - (c) 85
 - (d) 80
 - (e) 70
21. Joe had 3 times as much money as Willy. After Joe spent \$60 and Willy spent \$10 they each had an equal amount of money. How much money did Joe have at first?
- (a) \$25
 - (b) \$30
 - (c) \$45
 - (d) \$75
 - (e) \$90

22. A coffee manufacturer is thinking about manufacturing a new blend of coffee that sells for \$2.70 per pound by mixing two different coffees that sell for \$2.00 and \$5.50 per pound. How many pounds of the \$2.00 per pound coffee should be blended with 20 pounds of the \$5.50 per pound coffee to obtain the desired mixture?
- (a) 80
 - (b) 90
 - (c) 60
 - (d) 50
 - (e) 20
23. Jim requires \$8,000 per year in extra income. He has \$70,000 to invest and can invest in noninsured B-rated bonds paying 20% per year or in a government-insured Certificate of Deposit (CD) paying 9% per year. How much money should be invested in B-rated bonds to obtain exactly \$8000 in interest per year?
- (a) $\$ \frac{160,000}{11}$
 - (b) $\$ \frac{120,000}{11}$
 - (c) $\$ \frac{70,000}{11}$
 - (d) $\$ \frac{170,000}{11}$
 - (e) $\$ \frac{80,000}{11}$
24. Jackie and Jessy, working together, can plant a garden in 6 hours. Jessy takes 5 more hours than Jackie to plant this garden by herself. How long will it take Jackie to plant the garden?
- (a) 10 hours
 - (b) 1 hour
 - (c) 11 hours
 - (d) 3 hours
 - (e) 14 hours
25. Naomi and Shaleza go hiking on the Appalatian trail. Naomi starts hiking 3 hours after Shaleza. Naomi travels at 3.5 miles per hour, Shaleza travels at 3 miles per hour. How long will it take Naomi to catch up to Shaleza?
- (a) 21 hours
 - (b) 18 hours
 - (c) 20 hours
 - (d) 23 hours
 - (e) 19 hours

26. A boat heads upstream a distance of 30 miles on the Mississippi river, whose current is running at 5 miles per hour. If the trip back takes an hour less, what was the speed of the boat in still water?
- (a) $\sqrt{237}$ m.p.h.
 - (b) 5 m.p.h.
 - (c) $\sqrt{307}$ m.p.h.
 - (d) $\sqrt{501}$ m.p.h.
 - (e) $\sqrt{325}$ m.p.h.
27. Alex needs to make 500 ml of a solution that is 15% sulfuric acid by mixing a 10% sulfuric acid solution with a 20% sulfuric acid solution. How much of each solution will she need?
- (a) 250 ml 10%, 250 ml 20%
 - (b) 200 ml 10%, 300 ml 20%
 - (c) 300 ml 10%, 200 ml 20%
 - (d) 350 ml 10%, 150 ml 20%
 - (e) no solution
28. Martin purchased some municipal bonds yielding 8% annually and some certificates of deposit yielding 11% annually. If Martin's investment amounts to \$23,000 and the annual income is \$2,230, how much money is invested in certificates of deposit?
- (a) \$12,500
 - (b) \$13,000
 - (c) \$12,000
 - (d) \$10,000
 - (e) \$8,500
29. A car dealer, at a year-end clearance, reduces the list price of last year's models by 15%. If a certain four-door model has a discounted price of \$8000, what was its list price? How much can be saved by purchasing last year's model?
30. Christopher can paint the interior of his house in 15 hours. If he hires Cynthia to help him, they can do the same job together in 9 hours. If he lets Cynthia work alone, how long will it take her to paint the interior of his house?
31. A motorboat can maintain a constant speed of 16 miles per hour relative to the water. The boat makes a trip upstream to a marina in 20 minutes. The return trip takes 15 minutes. What is the speed of the current?

$$32. \frac{2 - \sqrt{5}}{2 + 3\sqrt{5}} =$$

(a) $\frac{2}{5}$

(b) $\frac{8\sqrt{5} - 19}{41}$

(c) $\frac{11 + 5\sqrt{5}}{41}$

(d) $\frac{19 - 8\sqrt{5}}{41}$

(e) $\frac{11 + 5\sqrt{5}}{-41}$

$$33. \frac{3 + 5\sqrt{3}}{4 - 2\sqrt{3}} =$$

$$(a) \frac{-9 + 7\sqrt{3}}{2}$$

$$(b) \frac{-18 - 14\sqrt{3}}{4}$$

$$(c) \frac{21 + 13\sqrt{3}}{2}$$

$$(d) \frac{42 - 26\sqrt{3}}{4}$$

$$(e) \frac{-21 + 13\sqrt{3}}{2}$$

$$34. \frac{6 \pm \sqrt{36 - 4(-3)}}{6}$$

$$(a) 1 \pm 2\sqrt{3}$$

$$(b) -1 \pm 2\sqrt{3}$$

$$(c) \frac{3 \pm \sqrt{3}}{3}$$

$$(d) \frac{6 \pm \sqrt{3}}{3}$$

$$(e) \frac{3 \pm 2\sqrt{3}}{3}$$

$$35. \frac{4 \pm \sqrt{84}}{2} =$$

$$(a) 4 \pm 2\sqrt{21}$$

$$(b) 8 \pm \sqrt{21}$$

$$(c) -1 \pm \sqrt{21}$$

$$(d) 2 \pm \sqrt{21}$$

$$(e) 4 \pm \sqrt{21}$$

$$36. \frac{6 \pm \sqrt{40}}{6} =$$

$$(a) 3 \pm 2\sqrt{10}$$

$$(b) -3 \pm 2\sqrt{10}$$

$$(c) \frac{3 \pm \sqrt{10}}{3}$$

$$(d) \frac{-3 \pm \sqrt{10}}{3}$$

$$(e) 1 \pm 2\sqrt{10}$$

37. $\frac{4 \pm \sqrt{56 - 7(-4)}}{2} =$

(a) $4 \pm 2\sqrt{21}$

(b) $2 \pm \sqrt{21}$

(c) $-1 \pm \sqrt{21}$

(d) $8 \pm \sqrt{21}$

(e) $4 \pm \sqrt{21}$

38. Find the real solution(s) of the equation $2 + \frac{5}{6x - 1} = \frac{-2}{(6x - 1)^2}$

(a) $-\frac{1}{12}, 2$

(b) $\frac{1}{2}, \frac{2}{3}$

(c) $\frac{1}{6}, \frac{1}{12}$

(d) $-2, -\frac{1}{2}$

(e) $-\frac{1}{6}, \frac{1}{12}$

39. Find the real solution(s) of the equation $x^{\frac{2}{3}} + 3x^{\frac{1}{3}} - 10 = 0$

(a) $-2^3, 5^3$

(b) $-5, 2$

(c) $-2, 5$

(d) $-5^3, 2^3$

(e) no solution

40. Find the real solutions of the equation $x^2 + 5x - \sqrt{x^2 + 5x} = 2$

(a) $\frac{-5 + \sqrt{39}}{2}, \frac{-5 - \sqrt{39}}{2}$

(b) $\frac{-5 + \sqrt{7}}{2}, \frac{-5 - \sqrt{7}}{2}$

(c) $\frac{-5 + \sqrt{41}}{2}, \frac{-5 - \sqrt{41}}{2}$

(d) $\frac{5 + \sqrt{7}}{2}, \frac{5 - \sqrt{7}}{2}$

(e) $\frac{5 + \sqrt{39}}{2}, \frac{5 - \sqrt{39}}{2}$

41. Find the real solution(s) of the equation $-\frac{1}{2} - \frac{1}{3}x = \frac{4}{3}$

- (a) $\frac{5}{2}$
- (b) $\frac{11}{2}$
- (c) $\frac{2}{3}$
- (d) $-\frac{11}{2}$
- (e) $-\frac{5}{2}$

42. The real solutions of the quadratic equation $3x^2 + 4x - 1 = 0$ is/are

- (a) $\frac{-4 \pm 2\sqrt{7}}{3}$
- (b) $\frac{4 \pm 2\sqrt{7}}{3}$
- (c) $\frac{-2 \pm \sqrt{7}}{6}$
- (d) $\frac{-2 \pm \sqrt{7}}{3}$
- (e) $\frac{-2 \pm 2\sqrt{7}}{3}$

43. The **sum** of the solutions of the equation $3x^2 + 5x + 2 = 0$ is equal to

- (a) $\frac{1}{3}$
- (b) 2
- (c) $\frac{2}{3}$
- (d) $-\frac{2}{3}$
- (e) $-\frac{5}{3}$

44. Solve: $\sqrt{2x + 3} = x$

45. Find the real solutions: $\sqrt[3]{1 - 2x} - 3 = 0$

46. Find the real solutions: $2x^4 - 5x^2 - 12 = 0$

47. Find the real solutions: $x^2 - 3x - \sqrt{x^2 - 3x} = 2$

48. Solve for x : $\frac{x}{a} + \frac{x}{b} = c$

(a) $\frac{ab}{c(a+b)}$

(b) $\frac{c(a+b)}{ab}$

(c) $\frac{a+b}{c(b-a)}$

(d) $\frac{abc}{a+b}$

(e) $-\frac{ab}{c(a+b)}$

49. Solve by factoring: $x^2 = 12 - x$

50. Solve by factoring: $x - \frac{10}{x} = -3$

51. Solve over the reals by factoring: $p^2 - 8 = 0$

52. Solve using the quadratic formula: $2s^2 + 5s = -2$

53. Solve the equation $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ for R

(a) $R = \frac{R_1 + R_2}{2}$

(b) $R = \frac{R_1 R_2}{R_1 + R_2}$

(c) $R = R_1 + R_2$

(d) $R = \frac{R_1 + R_2}{R_1 R_2}$

(e) $R = \frac{2}{R_1 + R_2}$

54. Solve for x : $\frac{a}{x} + \frac{b}{x} = \frac{1}{c}$

(a) $\frac{ab}{c(a+b)}$

(b) $\frac{a+b}{c}$

(c) $c(a+b)$

(d) $\frac{c}{a+b}$

(e) $\frac{ab}{c(a+b)}$

55. Solve the equation $A = P(1 + rt)$ for t

(a) $\frac{P - A}{rP}$

(b) $\frac{A - P}{rP}$

(c) $\frac{rP}{A - P}$

(d) $\frac{A + P}{rP}$

(e) $\frac{rP}{A + P}$

56. After performing the indicated operations and simplifying $\left(\frac{x^{\frac{1}{2}}}{y^2}\right)^4 \cdot \left(\frac{y^{\frac{1}{3}}}{x^{-\frac{2}{3}}}\right)^3$ equals

(a) $\frac{1}{x^4y^7}$

(b) $\frac{y^7}{x^4}$

(c) $\frac{y^{-7}}{x^{-4}}$

(d) $\frac{x^4}{y^7}$

(e) x^4y^7

57. A wool suit discounted by 20% for clearance sale has a price tag of \$160.00. What was it's original price?

(a) \$180.00

(b) \$196.00

(c) \$192.00

(d) \$200.00

(e) \$220.00

58. A total of \$10,000 is to be divided between Sean and George, with George to receive \$3,000 less than Sean. How much will George receive?

- (a) \$5,500
- (b) \$3,500
- (c) \$3,000
- (d) \$4,500
- (e) \$4,000

59. After completing the square, the quadratic equation $x^2 + 5x + 4 = 0$ is equivalent to the equation

- (a) $\left(x + \frac{5}{2}\right)^2 = \frac{9}{4}$
- (b) $\left(x + \frac{5}{4}\right)^2 = \frac{9}{4}$
- (c) $\left(x - \frac{5}{4}\right)^2 = \frac{9}{4}$
- (d) $\left(x + \frac{5}{2}\right)^2 = -\frac{3}{2}$
- (e) $\left(x + \frac{5}{2}\right)^2 = \frac{3}{2}$

60. If $k = \frac{x+3}{x-4}$ and $k^2 - 2k = 24$, find x .

- (a) $12, \frac{13}{5}$
- (b) $\frac{27}{5}, \frac{13}{5}$
- (c) $\frac{9}{2}, \frac{13}{5}$
- (d) $-\frac{9}{2}, \frac{13}{5}$
- (e) $\frac{1}{12}, \frac{5}{13}$

61. Solve for x : $\frac{a}{x} = c - \frac{b}{x}$

- (a) $c(a+b)$
- (b) $\frac{ab}{c(a+b)}$
- (c) $\frac{a+b}{c}$
- (d) $-\frac{ab}{c(a+b)}$
- (e) $\frac{c}{a+b}$

62. Solve the equation: $7 - (2x - 1) = 10$.

63. Solve the equation: $\frac{2x + 1}{3} + 16 = 3x$.

64. Solve the equation: $\frac{2x}{x + 3} = \frac{-6}{x + 3} - 2$.

65. If the discriminant of the equation $ax^2 + bx + c = 0$ is equal to zero then this implies that

- (a) there are two distinct real solutions
- (b) there are no real solutions
- (c) there is one real repeated solution
- (d) there are two imaginary solutions
- (e) none of the other choices

66. A ball is thrown vertically upward from the top of a building 96 feet tall with an initial velocity of 80 feet per second. The distance s (in feet) of the ball from the ground after t seconds is $s = -16t^2 + 80t + 96$.

- i.** After how many seconds does the ball strike the ground? Answer: $t = 6$ seconds.
- ii.** After how many seconds will the ball pass the top of the building on the way down? Answer: $t = 5$ seconds.
- iii.** After how many seconds will the ball reach it's maximum height? Answer: $t = \frac{5}{2}$ seconds.
- iv.** What maximum height does the ball attain? Answer: 196 feet.

67. Find the real solution(s) of the equation $\sqrt{3x + 7} + \sqrt{x + 2} = 1$.

68. Find the real solution(s) of the equation $\sqrt{3 - 2\sqrt{x}} = \sqrt{x}$.

69. Find the real solution(s) of the equation $4x^{\frac{1}{2}} - 9x^{\frac{1}{4}} + 4 = 0$. Answer: $x = \left(\frac{9 \pm \sqrt{17}}{8}\right)^4$

70. Find the real solution(s) of the equation $2x^{-2} - 3x^{-1} - 4 = 0$.

71. Find k such that the equation $x^2 - kx + 4 = 0$ has repeated real solution. Answer: $k = \pm 4$

Bonus Problem

Let $\alpha, \beta, \gamma, \in \mathbb{R}$ where $\alpha \neq 0$. Consider the equation

$$\alpha x^2 + \beta x + \gamma = 0$$

Find a formula for the solution of this equation. That is to say, derive the quadratic formula. Justify all steps. Your solution must be clear and mathematically precise. **No partial credit will be given.**