Solving Exponential and Logarithmic Equations

CLASS EXAMPLES - EXPONENTIAL EQUATIONS: Solve each equation.

1) $5^{3a} = 5^{2a+2}$

2) $32^{2x} = 2^4$

EXPONENTIAL EQUATIONS: Solve each equation.

3) $625^{x+1} = 25^x$

4) $36^{3m} = 216^{-m}$

5) $3^{-3n-2} = 3^{3n-1}$

6) $64^{3x} = 16$

CLASS EXAMPLES: Solve each equation. Round your answers to the nearest ten-thousandth.

7) $10^a + 10 = 46$

8) $e^a = 26$

9) $10^{7x} = 12$

10) $e^{n-2} - 5 = 61$

Answers

CLASS EXAMPLES - EXPONENTIAL EQUATIONS: Solve each equation.

1) $5^{3a} = 5^{2a+2}$

$\{2\}$

2) $32^{2x} = 2^4$

$\left\{\dfrac{2}{5}\right\}$

EXPONENTIAL EQUATIONS: Solve each equation.

3) $625^{x+1} = 25^x$

$\{-2\}$

4) $36^{3m} = 216^{-m}$

$\{0\}$

5) $3^{-3n-2} = 3^{3n-1}$

$\left\{-\dfrac{1}{6}\right\}$

6) $64^{3x} = 16$

$\left\{\dfrac{2}{9}\right\}$

CLASS EXAMPLES: Solve each equation. Round your answers to the neares ten-thousandth.

7) $10^a + 10 = 46$

1.5563

8) $e^a = 26$

3.2581

9) $10^{7x} = 12$

0.1542

10) $e^{n-2} - 5 = 61$

6.1897

Solve each equation. Round your answers to the nearest ten-thousandth.

11) $4^x = 72$

12) $e^{b-2} = 12$

13) $e^r - 7 = 57$

14) $13^{-10r} + 2 = 48$

CLASS EXAMPLES: Solve each equation. (LOGS ON BOTH SIDES)

15) $\log_4 (b^2 + 11) = \log_4 (-10b + 2)$

16) $\ln (x + 4) + \ln 3 = \ln 63$

17) $\log_6 9 - \log_6 (x - 2) = \log_6 49$

18) $\log (x^2 + 9) + \log 2 = \log 36$

Solve each equation.

19) $\ln (2k + 7) = \ln (-k - 8)$

20) $\ln -5v = \ln (3v + 3)$

21) $\log_{20} (n^2 + 6n) = \log_{20} (-20 - 3n)$

22) $\log_4 -3x - \log_4 2 = \log_4 43$

Answers

Solve each equation. Round your answers to the nearest ten-thousandth.

11) $4^x = 72$

    3.085

12) $e^{b-2} = 12$

    4.4849

13) $e^r - 7 = 57$

    4.1589

14) $13^{-10r} + 2 = 48$

    -0.1493

CLASS EXAMPLES: Solve each equation. (LOGS ON BOTH SIDES)

15) $\log_4 (b^2 + 11) = \log_4 (-10b + 2)$

    $\{-9, -1\}$

16) $\ln (x + 4) + \ln 3 = \ln 63$

    $\{17\}$

17) $\log_6 9 - \log_6 (x - 2) = \log_6 49$

    $\left\{ \dfrac{107}{49} \right\}$

18) $\log (x^2 + 9) + \log 2 = \log 36$

    $\{3, -3\}$

Solve each equation.

19) $\ln (2k + 7) = \ln (-k - 8)$

    No solution.

20) $\ln -5v = \ln (3v + 3)$

    $\left\{ -\dfrac{3}{8} \right\}$

21) $\log_{20} (n^2 + 6n) = \log_{20} (-20 - 3n)$

    No solution.

22) $\log_4 -3x - \log_4 2 = \log_4 43$

    $\left\{ -\dfrac{86}{3} \right\}$

23) $\log_4 3x^2 - \log_4 6 = 3$

24) $\ln x - \ln (x - 2) = \ln 28$

CLASS EXAMPLES: Solve each equation. (LOGS ON ONE SIDE)

25) $\log_4 n = 0$

26) $\ln (p + 2) = 3$

27) $1 + \log_8 5r = 5$

28) $\log_2 9 + \log_2 4x^2 = 4$

Solve each equation.

29) $\log_8 n = 2$

30) $\log_9 (n + 7) = 4$

31) $\log_2 9r = 3$

32) $2\log_8 x = -2$

33) $10\log_5 x = 0$

34) $2\log 10n = 6$

35) $\log_3 (x + 6) - \log_3 x = 5$

36) $\log_7 2x + \log_7 8 = 1$

Answers

23) $\log_4 3x^2 - \log_4 6 = 3$

$\{8\sqrt{2}, -8\sqrt{2}\}$

24) $\ln x - \ln (x - 2) = \ln 28$

$\left\{\dfrac{56}{27}\right\}$

CLASS EXAMPLES: Solve each equation. (LOGS ON ONE SIDE)

25) $\log_4 n = 0$

$\{1\}$

26) $\ln (p + 2) = 3$

$\{e^3 - 2\}$

27) $1 + \log_8 5r = 5$

$\left\{\dfrac{4096}{5}\right\}$

28) $\log_2 9 + \log_2 4x^2 = 4$

$\left\{\dfrac{2}{3}, -\dfrac{2}{3}\right\}$

Solve each equation.

29) $\log_8 n = 2$

$\{64\}$

30) $\log_9 (n + 7) = 4$

$\{6554\}$

31) $\log_2 9r = 3$

$\left\{\dfrac{8}{9}\right\}$

32) $2\log_8 x = -2$

$\left\{\dfrac{1}{8}\right\}$

33) $10\log_5 x = 0$

$\{1\}$

34) $2\log 10n = 6$

$\{100\}$

35) $\log_3 (x + 6) - \log_3 x = 5$

$\left\{\dfrac{3}{121}\right\}$

36) $\log_7 2x + \log_7 8 = 1$

$\left\{\dfrac{7}{16}\right\}$

6

37) $\log_5 (x^2 - 10) + \log_5 9 = 1$

38) $\log_7 4x^2 + \log_7 4 = 4$

39) Sophie is buying a used car for $4,500.00. The car is depreciating at a rate of 5% each month.

    a) Write an equation which models the value of the car after "x" months.

    b) How much will the car be worth after 8 months?

    c) When will the car's value be $2,000?

40) William has a goat farm with 6 goats. It is predicted that the goat population will grow at a rate of 20% each year.

    a) Write an equation which will model the number of goats he has after "x" years.

    b) How many goats will William have after 10 years?

    c) How long will it take William to end up with a herd of 20 goats?

41) Mr. Allen-Black deposited $3,200 into a savings account, which pays him 3.5% APR.

    a) How much will Mr. Allen-Black have accrued in the account after 5 years if the interest is compounded quarterly?

    b) How much less (or more?) would Mr. Allen-Black have accrued in 5 years if the interest were compounded continuously?

    c) How many years would it take Mr. A-B to accrue $10,000 considering the interest is compounded quarterly?

    d) How many years would it take Mr. A-B to accrue $10,000 if the interest was compounded continuously?

Answers

37) $\log_5 (x^2 - 10) + \log_5 9 = 1$

$$\left\{ \frac{\sqrt{95}}{3}, -\frac{\sqrt{95}}{3} \right\}$$

38) $\log_7 4x^2 + \log_7 4 = 4$

$$\left\{ \frac{49}{4}, -\frac{49}{4} \right\}$$

39) Sophie is buying a used car for $4,500.00. The car is depreciating at a rate of 5% each month.

    a) Write an equation which models the value of the car after "x" months.

    b) How much will the car be worth after 8 months?

    c) When will the car's value be $2,000?

    a) $y = 4500 \cdot 0.95^x$ b) $2,985.39   c) 15.81 months

40) William has a goat farm with 6 goats. It is predicted that the goat population will grow at a rate of 20% each year.

    a) Write an equation which will model the number of goats he has after "x" years.

    b) How many goats will William have after 10 years?

    c) How long will it take William to end up with a herd of 20 goats?

    a) $y = 6 \cdot 1.2^x$ b) 37.15 goats   c) 6.604 Years

41) Mr. Allen-Black deposited $3,200 into a savings account, which pays him 3.5% APR.

    a) How much will Mr. Allen-Black have accrued in the account after 5 years if the interest is compounded quarterly?

    b) How much less (or more?) would Mr. Allen-Black have accrued in 5 years if the interest were compounded continuously?

    c) How many years would it take Mr. A-B to accrue $10,000 considering the interest is compounded quarterly?

    d) How many years would it take Mr. A-B to accrue $10,000 if the interest was compounded continuously?

    a) $3809.09   b) $2.90 more   c) 32.70 yrs.   d) 32.56 yrs.