

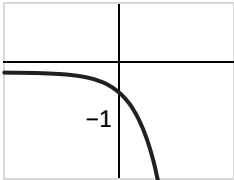
LESSON 180

- | | | | |
|-----------|------------|-----------------|------------|
| 1. 8 | 2. 2 | 3. -4 | 4. -1 |
| 5. A, C | 6. 16 | 7. 5 | 8. A, B, E |
| 9. B | 10. 1 | 11. 1, 4 | 12. B |
| 13. 4 hrs | 14. 15 | 15. -3 | 16. 9 |
| 17. 4 | 18. A | 19. $x + 2$ | 20. 7 |
| 21. B | 22. 12 hrs | 23. $2\sqrt{2}$ | 24. 5 |
| 25. -1 | 26. 1.458 | 27. 1,335 | 28. C |
| 29. 900 | 30. $1/5$ | | |

Worked-out solutions:

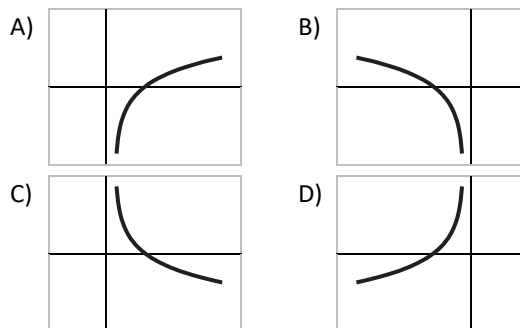
- $|x - 3| + 1 = 6$
 $|x - 3| = 5$ Isolate the absolute value.
 $x - 3 = 5$ or $x - 3 = -5$ Rewrite as two equations.
 $x = 8, x = -2$ Solve each equation.
 The positive solution is $x = 8$.
- First, find the equation of the line.
 $m = \frac{3 - 6}{1 - 0} = -3$ Find the slope using the slope formula.
 $b = 6$ $(0, 6)$ is the y -intercept.
 $y = mx + b$ Slope-intercept form
 $y = -3x + 6$ Plug in m and b .
 Then, find the x -intercept.
 $0 = -3x + 6$ Set $y = 0$.
 $x = 2$ Solve for x .
- $6x + 2y = 2$ eq1 $\times 2$
 $x + 2y = 7$ eq2
 $5x = -5$ Subtract the equations.
 $x = -1$ Solve for x .
 $3(-1) + y = 1$ Plug x into eq1.
 $y = 4$ Solve for y .
 $ab = (-1)(4) = -4$
- $(x + 1)^2 = x + 3$
 $x^2 + 2x + 1 = x + 3$ Expand each side.
 $x^2 + x - 2 = 0$ Write in standard form.
 $m + n = \text{sum of roots} = -b/a = -1/1 = -1$
- A) The graph crosses the x -axis at $x = 2$ because $x = 2$ has an odd multiplicity of 1.
 B) The graph touches the x -axis at $x = -1$ because $x = -1$ has an even multiplicity of 2.
 C) Test a point. $f(0) = -4 < 0$
 D) The leading term is $2x^3$. The degree is 3 (odd). The leading coefficient is 2 (positive). The left end of the graph goes down and the right end goes up.

- $(8x^2)(2x^{-3})^{-2} = (2^3x^2)(2^{-2}x^6) = 2^{3-2}x^{2+6} = 2x^8$
 $ak = 2(8) = 16$
- $3^{x-1} = 9^{x-3}$
 $3^{x-1} = (3^2)^{x-3}$ Rewrite using base 3.
 $3^{x-1} = 2^{2(x-3)}$ Exponent rules
 $x - 1 = 2(x - 3)$ One-to-one property
 $x = 5$ Solve for x .

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 Sketch the graph.
 1. Graph $y = e^x$
 2. Reflect over the x -axis to get $f(x) = -e^x$.

- The y -intercept is $f(0) = -e^0 = -1$.
 - The asymptote of $y = e^x$ is $y = 0$. The reflection does not change the asymptote.
 - As x increases, $f(x)$ decreases.
As x decreases, $f(x)$ approaches 0.
 - The graph is in Quadrants III and IV.
- Compound interest is exponential growth. $B(t)$ must be an exponential function, so eliminate C and D.
 Each year's balance is 104% of the previous year's balance, or 1.04 times the previous year's balance. The growth factor is 1.04, so choose B.
 - $\log_3 1 = 0$ Zero rule
 $\log_3 3 = 1$ Identity rule
 $\log_3 27 = \log_3 3^3 = 3$ Use $\log_b b^n = n$.
 $\log_3 1 - 2\log_3 3 + \log_3 27 = 0 - 2(1) + 3 = 1$
 - $\ln x + \ln 9 = 2 \ln(x + 2)$
 $\ln 9x = \ln(x + 2)^2$ Logarithm rules
 $9x = (x + 2)^2$ One-to-one property
 $x^2 - 5x + 4 = 0$ Standard form
 $(x - 1)(x - 4) = 0$ Solve for x .
 $x = 1, x = 4$
 Both solutions are valid.

- $y = \log_2 x$ is reflected over the y -axis.



13. The initial amount is 100 mg.

The decay factor is $100\% - 17\% = 83\% = 0.83$.

The function $y = 100(0.83)^t$ models the amount of caffeine in the body t hours after drinking a cup of coffee.

Use the function to find t when $y = 50$.

$$50 = 100(0.83)^t$$

$$(0.83)^t = 1/2$$

$$t = \log_{0.83}(1/2) = \frac{\ln(1/2)}{\ln 0.83} = 3.72000 \dots$$

It will take about 4 hours.

14. $\sqrt[5]{32} + 64^{2/3} - 81^{1/4}$

$$= \sqrt[5]{2^5} + (4^3)^{2/3} + (3^4)^{1/4}$$

$$= 2 + 4^2 - 3 = 15$$

15. $x^{2/5}(x^3)^{2/5} = x^{2/5}x^{6/5} = x^{8/5} = \sqrt[5]{x^8}$

$$m - n = 5 - 8 = -3$$

16. $x - 4 = \sqrt{2x + 7}$

$$(x - 4)^2 = 2x + 7 \quad \text{Square both sides.}$$

$$x^2 - 10x + 9 = 0 \quad \text{Write in standard form.}$$

$$(x - 1)(x - 9) = 0 \quad \text{Solve for } x.$$

$$x = 1, x = 9$$

$x = 1$ is extraneous, so the solution is $x = 9$.

17. $(4x + 3)^{3/2} = 2^3$

$$[(4x + 3)^{3/2}]^{2/3} = (2^3)^{2/3} \quad \text{Raise to the reciprocal power, and solve for } x.$$

$$4x + 3 = 2^2$$

$$4x = 1$$

$$x = 1/4$$

$$x^{-1} = (1/4)^{-1} = 4 \quad \text{Negative exponent rule}$$

18. $(-3, -1)$ is on the graph, so eliminate B and D.

The graph does not involve a reflection, so choose A.

19. Multiply the numerator and denominator by the LCD of all fractions in the numerator and denominator.

$$\frac{1 - \frac{4}{x^2}}{\frac{1}{x} - \frac{2}{x^2}} = \frac{x^2 \left(1 - \frac{4}{x^2}\right)}{x^2 \left(\frac{1}{x} - \frac{2}{x^2}\right)}$$

$$= \frac{x^2 - 4}{x - 2} = \frac{(x + 2)(x - 2)}{x - 2} = x + 2$$

20. $\frac{2}{x} - \frac{1}{4} = \frac{2}{x^2 + x}$

$$\frac{2}{x} - \frac{1}{4} = \frac{2}{x(x + 1)}$$

Restrictions: $x \neq 0, -1$

LCD = $4x(x + 1)$

$$8(x + 1) - x(x + 1) = 8 \quad \text{Multiply both sides by the LCD, then solve for } x.$$

$$x^2 - 7x = 0$$

$$x(x - 7) = 0$$

$$x = 0, x = 7$$

$x = 0$ is extraneous, so the solution is $x = 7$.

21. $f(x)$ is $y = 1/x$ shifted left 3 units and up 2 units.

The vertical asymptote of $y = 1/x$ at $x = 0$ is shifted left 3 unit to $x = -3$.

The horizontal asymptote of $y = 1/x$ at $y = 0$ is shifted up 2 units to $y = 2$.

22. x = pipe B's time alone

Pipe A's rate + Pipe B's rate = combined rate, so

$$\frac{1}{4} + \frac{1}{x} = \frac{1}{3}$$

Solve for x , and you get $x = 12$.

It will take 12 hours.

23. Convert to standard form by completing the square.

$$x^2 + y^2 + 4x - 6y + 5 = 0$$

$$x^2 + y^2 + 4x - 6y = -5$$

$$x^2 + 4x + y^2 - 6y = -5$$

$$(x^2 + 4x + 4) + (y^2 - 6y + 9) = -5 + 4 + 9$$

$$(x + 2)^2 + (y - 3)^2 = 8$$

$$\text{Radius} = \sqrt{8} = 2\sqrt{2}$$

24. $(x - 2)^2 + (x - 3)^2 = 25$ Plug eq2 into eq1.

$$2x^2 - 10x + 12 = 0 \quad \text{Write in standard form.}$$

$$\text{Sum of roots} = -b/a = -(-10)/2 = 5$$

25. The graphs intersect at one point.

= The system has one real solution.

$$2x + k = x^2 - 2x + 3 \quad \text{Plug eq2 into eq1.}$$

$$x^2 - 4x + 3 - k = 0 \quad \text{Write in standard form.}$$

The discriminant, $b^2 - 4ac$, must be zero.

$$(-4)^2 - 4(1)(3 - k) = 0 \quad \text{Set discriminant} = 0.$$

$$k = -1 \quad \text{Solve for } k.$$

26. This is a geometric sequence with $a_1 = 2$ and $r = 3$.

$$a_n = a_1 r^{n-1} = 2(3)^{n-1}$$

$$a_7 = 2(3)^6 = 1458$$

27. This is an arithmetic sequence with $a_1 = 1$ and $d = 3$.

$$a_n = 1 + 3(n - 1) = 3n - 2$$

$$a_{30} = 3(30) - 2 = 88$$

$$S_{30} = \frac{30}{2}(a_1 + a_{30}) = \frac{30}{2}(1 + 88) = 1335$$

28. Mean = sum divided by count = 4.5
Median = middle value when ordered = 4.5
29. Estimate = population size · sample proportion
 $1200(60/80) = 900$
A reasonable estimate is 900 employees.

30.

tea coffee

5 6 10 4

$P(\text{tea only})$
 $= 5/25$
 $= 1/5$