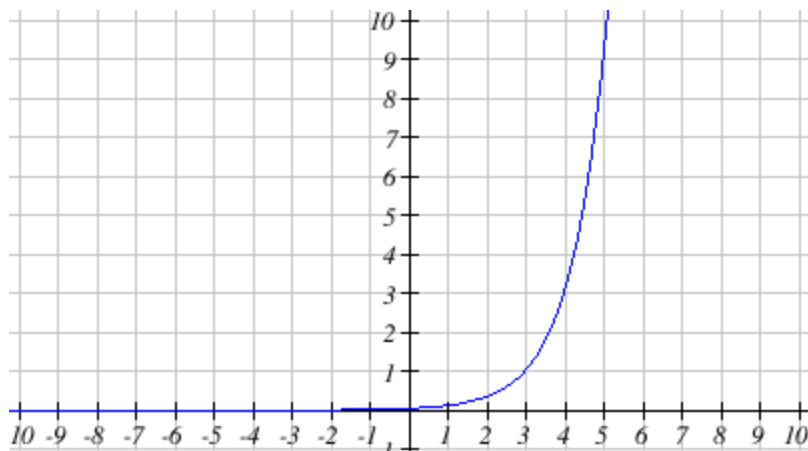


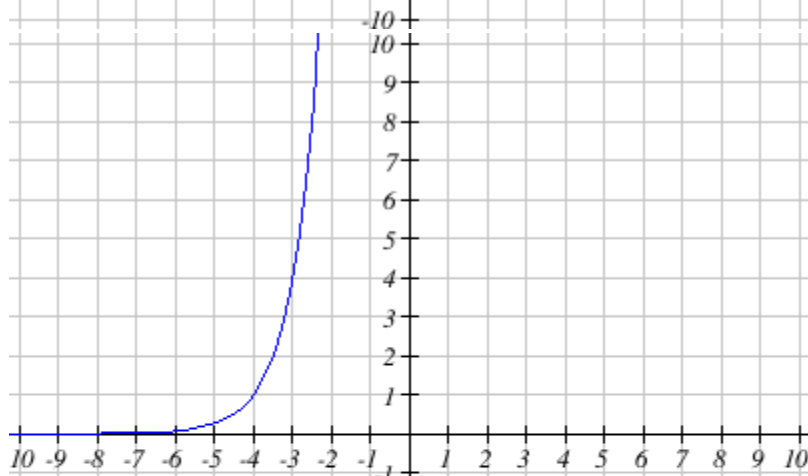
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## Lecture 20 Answers

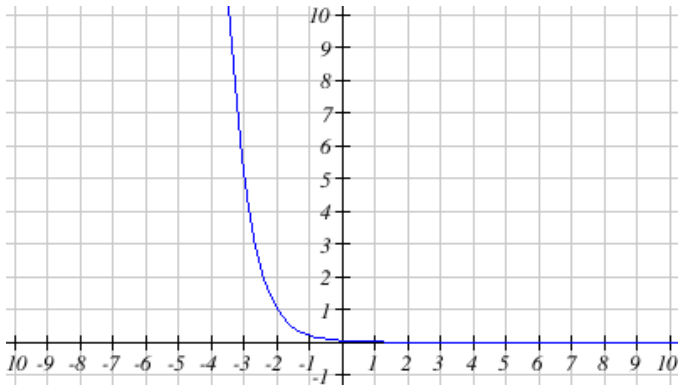
1. NOT an exponential function
2. exponential growth
3. exponential decay
4.  
The Domain of the exponential functions is All Real Numbers .  
The Range of the exponential functions is  $f(x) > 0$  .  
The Horizontal Asymptote is the line  $y = 0$  .
5. orange (O), red (R), green (G)
6. c b a
7. 8, 4
8. 7000, 0.9
9.  $3(4)^x$
10.  $28100 \cdot (1.06)^t$ , 44787
11.  $12000(1.034)^t$
12.  $19000(0.92)^t$
13. 18259
14. 44.673881799593
15. -0.2260, -22.60, 4,650
16. 12.3
17. 0.0553, 5.53, 170,000
18. -0.1252, -12.52, 8,700
19. 5992.2, No, because by 2026, the radioactive element remaining in the area is greater than 800 Bqs.
20.  $C = 110 \cdot \left(\frac{1}{2}\right)^{\frac{t}{5.6}}$ , about 31.9 mg, about 13.77 hours
21.  $9^x + 4$ ,  $9^{x-1}$ ,  $-9^x$
22.  $f(x) = 2^x$
23.  $f(x) = \frac{1}{3} \cdot 4^x$
24.  $f(x) = \left(\frac{1}{5}\right)^x + 4$
25.  $f(x) = -3 \cdot 2^x - 2$
26.  $-2 \cdot \left(\frac{1}{3}\right)^x + 3$
27. 3,  $\infty$
28.  $\infty$ , -1



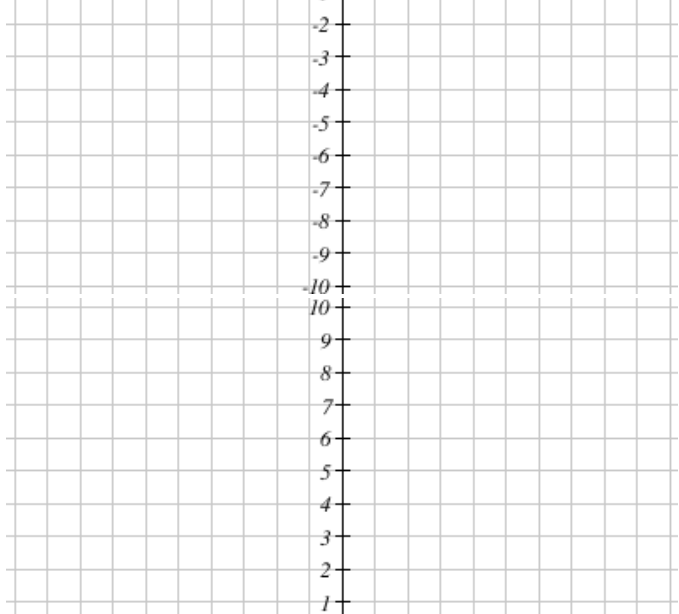
29.



30.



31.



32.

33.  $52$ ,  $y = 20$ ,

34.  $-4$

35.  $\frac{4}{5}$

36.  $4$

37.  $\frac{2}{5}$

38.  $-7$

39.  $0$

40.  $-4$

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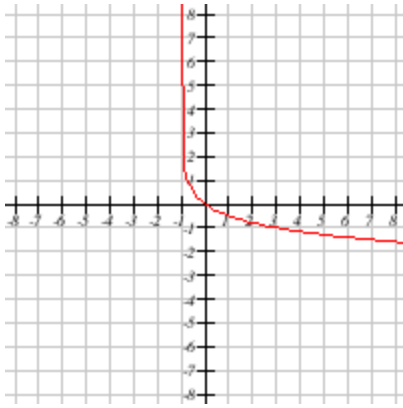
## Lecture 21 Answers

1. 20.0855 , 0.2276
2. 13 , 40
3. 64 , 10
4.  $-\frac{3}{4}$
5. exponential decay
6. exponential growth
7. 7312.1564832668 , 7458.1799602672 , 7492.8078533849 , 7510.4423170574
8. 2500 , 0.022 , 4 , 2,915.00 ,  
 $\left(1 + \frac{0.022}{4}\right)^4 - 1 = 0.0221822 = 2.218\%$
9.  $15400 \cdot e^{0.08 \cdot t}$  , 29205
10. 336 , 1.2214027581602
11.  $178(2.305)^t$
12. 25 , 960 , 3350.7292391634
13. 7 , -33 , 21.9 , -5.6 , 17
14. 6299.6052494744 , 163840000
15. 167.265321155
16. 64010.36
17. 45.947934199881
18. 78 , 53

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## Lecture 22 Answers

1.  $y^b = m$
2.  $10^c = s$
3.  $\log_9(n) = r$
4.  $\log(v) = c$
5. 3, 8, 2, 25
6. 4,  $\frac{1}{2}$ , 2, 2, -2,  $\frac{1}{4}$
7. 4,  $x$ ,  $x$ , 3
8.  $\log_3(81) = 4$ ,  $\log(0.001) = -3$
9.  $\ln(8) = x$ ,  $\ln(x) = 5$
10.  $343^{\frac{1}{3}} = 7$
11. 3
12. -1
13. -1
14. -5
15. -5, 3,  $\sqrt{2}$ , -5
16. -7,  $\frac{2}{5}$ , 5, 5,  $\sqrt{3}$
17. 279936
18.  $\frac{62}{5}$
19.  $\frac{e^4-5}{5}$
20.  $2^{\frac{8}{9}}$
21.  $3^{4^{-3}}$
22. 9
23. 2
24.  $\frac{1}{5}$
25. 4
26. -5
27. 12, 5, 5, 4
28. -42
29. -2, 4, 1,  $n$
30. 2.8325089127062
31.  $x = 4$



- 32.
33.  $10^x$      $e^x$      $\log x$      $\ln x$
34.  $(-\infty, 1)$
35.  $(-\infty, -2) \cup (1, \infty)$
36.  $(-\infty, -3) \cup (1, \infty)$
37.  $(-\frac{5}{2}, \infty), (-\infty, \infty)$
38. 3
39. 2.5118864315096E-13
40. 0.001, 0.00000031622776601684

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### Lecture 23 Answers

- The expression is undefined
- - $\log_b\left(\frac{1}{5}\right) = -\log_b(5)$
  - $\log_7(xy) = \log_7(x) + \log_7(y)$
  - $\log_2\left(\frac{x}{y}\right) = \log_2(x) - \log_2(y)$
- all of the above
- 0
- $N$
- $\log(5) + \log(c) - \log(11)$
- $20\log(x) + 11\log(y) - 2\log(z)$
- $139\ln(x) - 41\ln(y)$
- $3 - \log_9(x - 3) - \log_9(x + 3)$
- $20\ln(w) + 8\ln(x) - \frac{1}{5}\ln(z + 2)$
- $2 + 15\log_3(x) + 8\log_3(y)$
- $\frac{1}{3}(3\log(y) + 11\log(w) - 10\log(x))$
- 20.5, -23, -15
- 1.2852
- $\frac{5}{3}, \frac{5}{6}, -\frac{5}{6}$
- $f^{-1}(t) = \frac{\ln\left(\frac{t-6}{-5}\right)}{\ln 2}$
- $\log_3(5b^5)$
- $\log_3(b^2 + 5b)$
- $\log\left(\frac{7^3}{x^1}\right)$
- $\log_4(w^{20}x^5)$
- $\log_3\left(\frac{w^4x^9}{\sqrt[2]{y+17}}\right)$

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## Lecture 24 Answers

1. 1.5107
2. 8
3. 2
4.  $\frac{1}{4}$
5. 5
6. 32.661183087588
7. 5.1
8. 6.9818990268351
9.  $\frac{\log\left(\frac{18}{11}\right)}{\log\left(\frac{1.09}{1.12}\right)}$  or  $\frac{\log(18)-\log(11)}{\log(1.09)-\log(1.12)}$ , approximately -18.138436279487
10.  $\frac{\log\left(\frac{20}{9}\right)}{\log\left(\frac{1.17}{1.09}\right)}$  or  $\frac{\log(20)-\log(9)}{\log(1.17)-\log(1.09)}$ , approximately 11.27420867405
11.  $\ln(16) - \ln(4)$  or  $\ln(4)$ , 1.3863
12.  $1250(0.81)^t$ , 3.3
13.  $\ln\left(\frac{5}{18}\right) - 5$  (preferred) or  $\ln(5) - \ln(18) - 5$ , -6.2809
14. 10.127464398051
15.  $\frac{\log(23)}{\log(4)}$  or  $\log_4(23)$ , 2.2618
16.  $\frac{-1+\ln(13)}{4}$ , 0.8912
17.  $3 \frac{\log(3)}{\log(4)}$ , 2.3774
18. 403.4288
19. 16.0855
20. 4.7155
21. 200, 283, 18.9
22. No solution
23.  $\frac{\ln\left(\frac{7}{10}\right)}{3\ln(4)}$
24.  $\frac{10}{\ln(14)}$
25.  $\frac{\ln(4)}{3}$
26.  $\frac{\ln(36)}{\ln(3)}$
27.  $\frac{2\ln(3)-4\ln(5)}{7\ln(5)-\ln(3)}$ , -0.42
28.  $\frac{-3\ln(5)-5\ln(6)}{8\ln(6)-\ln(5)}$ , -1.08
29.  $x = \log_7(6) + 9$  or  $x = \frac{\ln(6)+9\ln(7)}{\ln(7)}$ ,  $x \approx 9.9208$
30. 9
31. 1.83333333333333
32. 36
33. 4, DNE
34. 1.0054299011128



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## Lecture 25 Answers

1. 2.6979578961226
2. 15.1
3. 6.1559990403261
4. 25198.420997897, 163840000
5. 1600, 0.85, 4.3
6. 85
7. 129.3311
8. 5730
9.  $60 + 70 \cdot e^{-0.2 \cdot t}$
10. 22,  $y = 21$ , The temperature of the coffee will eventually approach 21° Celsius
11. 6.9
12. 144, 52680, 575000
13. 13.5
14. 202 animals

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### Lecture 26 Answers

1. 1
2.  $\frac{180}{\pi}$ , 57.3,  $\frac{180}{\pi}x$ ,  $\frac{720}{\pi}$ , 229.18
3. 330
4.  $-210^\circ$
5.  $\frac{2\pi}{3}$
6.  $\frac{11\pi}{9}$ , 80
7. 296
8. 79, 235, 135, 39
9.  $266 + 360k$
10.  $\frac{-8\pi}{3}$ ,  $\frac{4\pi}{3}$
11. 120, -600
12.  $\frac{\pi}{3}$
13.  $42^\circ$ ,  $89^\circ$ ,  $30^\circ$ ,  $37^\circ$ ,  $84^\circ$
14. 145
15.  $\frac{11}{36} \cdot \pi = 0.95993108859688$
16. 6
17. 35.81
18. 25069.909375647, 23.740444484514
19.  $\frac{11660\pi}{528}$
20.  $\frac{45 \cdot \left(\frac{1}{60}\right) \cdot \left(\frac{1}{60}\right) \cdot \left(\frac{5280}{1}\right) \cdot \left(\frac{12}{1}\right)}{2 \cdot \pi \cdot (4.5 + 7.25)} = 10.727720419471$ , 59.212765957447, 28.212765957447
21.  $\frac{145\pi}{3}$  ft/sec, 151.8 ft/sec,  $\frac{725\pi}{22}$  mph, 103.5 mph
22.  $\frac{1}{2} \cdot 10.9^2 \cdot 0.5 = 29.7025$
23.  $\sqrt{\frac{2 \cdot 39}{\left(\frac{4}{5}\right) \cdot \pi}} = \sqrt{\frac{390}{4\pi}} = 5.5709257671342$
24. 378.30011536977

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### Lecture 27 Answers

1. III, II, I, IV

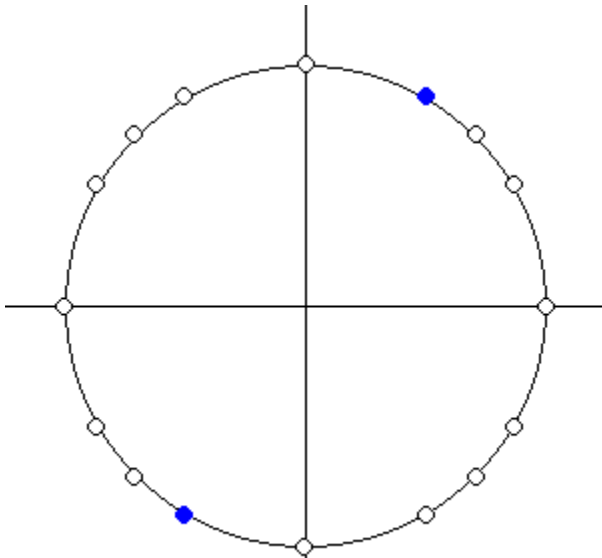
2.  $-\frac{2\sqrt{10}}{11}$

3.  $-\frac{6\sqrt{2}}{11}$

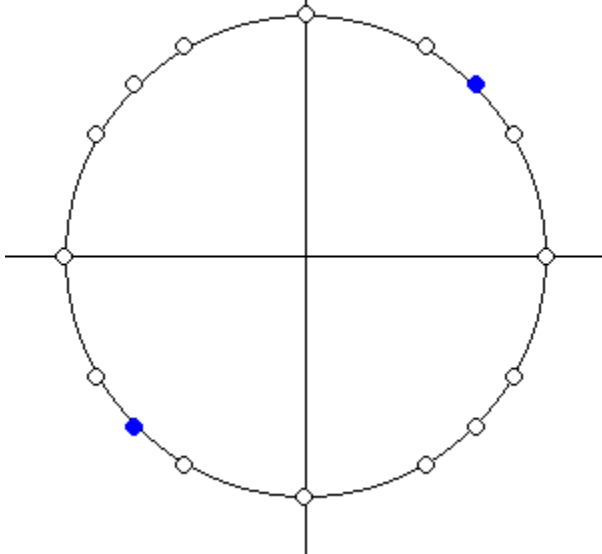
4.  $\frac{2\sqrt{30}}{13}$

5.  $0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{4}, \frac{5\pi}{6}, \pi, \frac{7\pi}{6}, \frac{5\pi}{4}, \frac{4\pi}{3}, \frac{3\pi}{2}, \frac{5\pi}{3}, \frac{7\pi}{4}, \frac{11\pi}{6}$

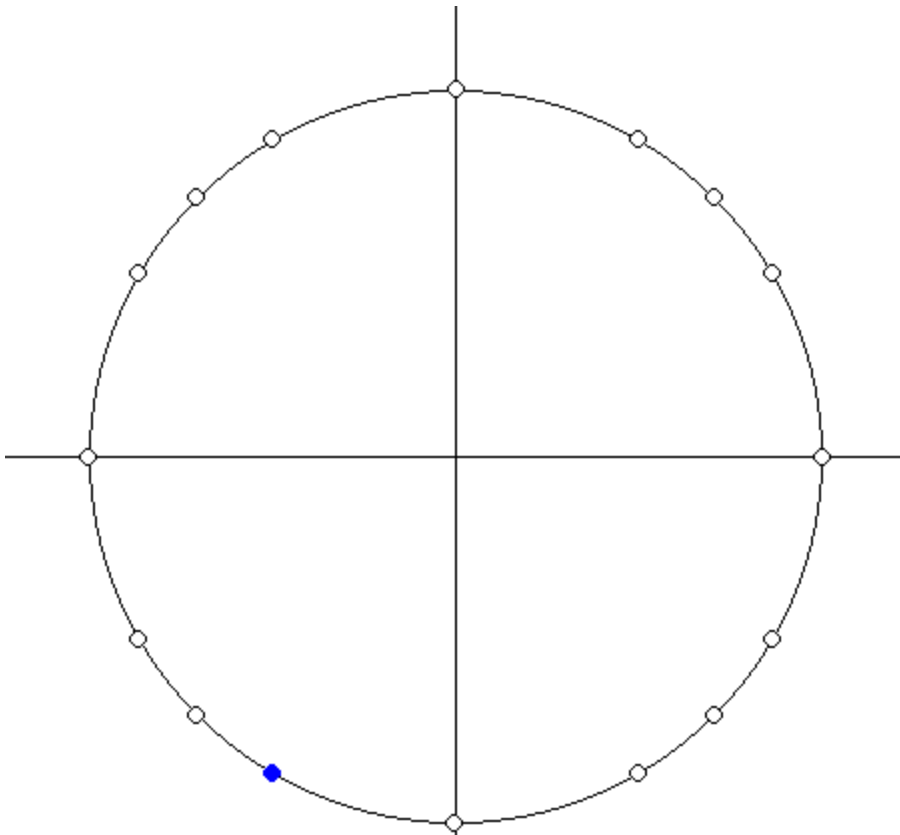
6. 0, 30, 45, 60, 90, 120, 135, 150, 180, 210, 225, 240, 270, 300, 315, 330



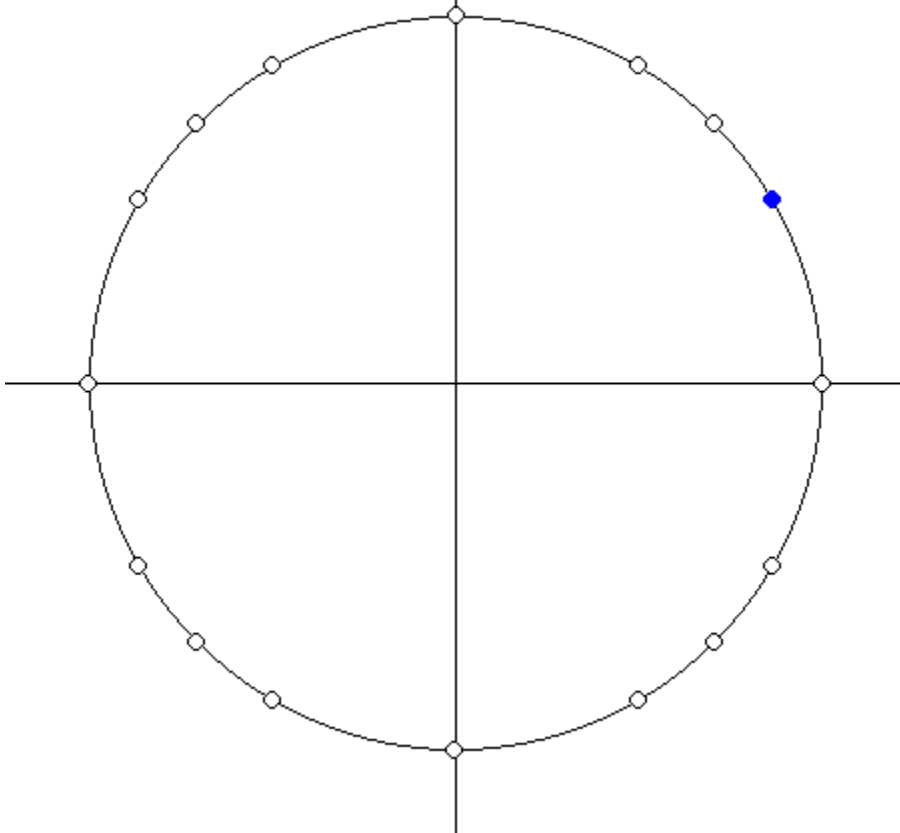
7.



8.



9.



10.

11. 300

12.  $-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}, \frac{1}{2}, \frac{\sqrt{3}}{2}$

13. 0.86602540378444
14. 1
15. 0.70710678118655
16. 1
17. 1
18. 2
19.  $\sqrt{3}$
20. 120, 300
21. 320, 140
22. 1