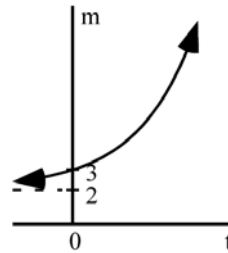
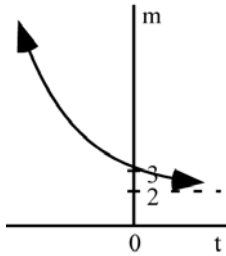


## Answers to Practice with Exponents and Logarithms

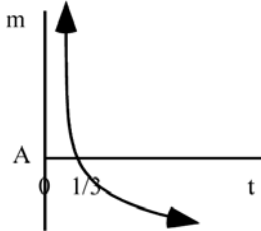
- 1)  $x^{10}$
- 2)  $a^n + a^\ell$  (cannot be simplified)
- 3)  $a^{n+\ell+q}$
- 4)  $(abc)^{-3} = 1/(abc)^3$
- 5)  $17^{n+\ell+q}$
- 6)  $m^{13}$
- 7)  $m^{-9} = 1/m^9$
- 8)  $u^{7/6}$
- 9)  $2^6 = 64$
- 10)  $a^6$
- 11)  $a^{-6}$
- 12) 1
- 13)  $a^n + a^\ell + a^q$   
(cannot be simplified)
- 14) 1
- 15) undefined
- 16) 3
- 17) 2
- 18) 4
- 19) -7
- 20) 0
- 21) 72
- 22)  $x^2 + \frac{y}{4}r^2$
- 23)  $\ln(x^3) = 3\ln(x)$
- 24) 0
- 25) 100
- 26)  $e^{120x-22}$
- 27)  $\ln x - \ln y$
- 28)  $27 \ln x$
- 29)  $\ln A + 84b \ln x - \ln y$
- 30)  $\ln(A + x^{84b}) - \ln y$
- 31)  $\ln A + qrs \ln x - s \ln y$
- 32)  $\ln(A + rx^n)$   
(cannot be simplified)
- 33)  $-\ln(x^{21}) = -21 \ln x$
- 34)  $\frac{\log_e 100}{\log_e 10} = \frac{\log_e 10^2}{\log_e 10} = 2$
- 35) One proof is:
- a)  $e^{\ln u} = u, e^{\ln v} = v, e^{\ln(uv)} = uv$   
(by definition of the logarithm)
- b)  $uv = e^{\ln u} e^{\ln v} = e^{\ln u + \ln v}$
- c)  $e^{\ln(uv)} = e^{\ln u + \ln v}$   
(using a and b)
- d)  $\ln(uv) = \ln u + \ln v$
- 36) A variant on (35).
- 37) One proof is:
- a)  $e^{\ln u} = u$  so  $e^{\ln y^{-2}} = y^{-2}$   
(using def'n of logarithm)
- b)  $y^{-2} = (e^{\ln y})^{-2} = e^{-2 \ln y}$
- c)  $e^{\ln y^{-2}} = e^{-2 \ln y}$   
(using a and b)
- d)  $\ln y^{-2} = -2 \ln y$
- 38)



39)



40)



You should realize why  $m = A$  when  $t = 1/3$ , and you should realize that there is no asymptote for  $m$  (it goes from  $-\infty$  to  $\infty$ ).

41)  $\$21 = \$7e^{r(10)}$ , so  $r = \frac{\log 3}{10}$ . The

time  $t_d$  it takes for productivity to double can be determined by  $\$14 = \$7e^{rt_d}$ , so that

$$t = \frac{\log 2}{r} = 10 \frac{\log 2}{\log 3}.$$