

## Exponential Graphs

### Starter

1. (Review of last lesson)

Solve: (a)  $5^{2x} - 6(5^x) - 7 = 0$  (b)  $3^{2x+2} - 260(3^x) - 29 = 0$

**Working:** (a) Let  $u = 5^x \Rightarrow u^2 - 6u - 7 = 0$   
 $(u - 7)(u + 1) = 0$   
 $u = 7$  or  $u = -1$   
 $5^x = 7$  or  $5^x = -1$   
 Take logs of both sides:  $\log 5^x = \log 7$  or No solution  
 3rd law:  $x \log 5 = \log 7$   
 Exact answers:  $x = \frac{\log 7}{\log 5}$   
 To 3 s.f.:  $x = 1.21$

(b)  $3^{2x+2} - 260(3^x) + 29 = 0 \Rightarrow 3^2 \times 3^{2x} - 260(3^x) - 29 = 0$   
 Let  $u = 3^x \Rightarrow 9u^2 - 260u - 29 = 0$   
 $(u - 29)(9u + 1) = 0$   
 $u = 29$  or  $u = -\frac{1}{9}$   
 $3^x = 29$  or  $3^x = -\frac{1}{9}$   
 Take logs of both sides:  $\log 3^x = \log 29$  or No solution  
 3rd law:  $x \log 3 = \log 29$  or  
 Exact answers:  $x = \frac{\log 29}{\log 3}$  or  
 To 3 s.f.:  $x = 3.07$

**E.g. 1** Find the gradient of the curve  $y = 2.5e^{6x}$  when:

(a)  $x = 5$  (b)  $x = \frac{1}{3}$ . Leave your answers in exact form.

**Working:** (a) The gradient of the curve  $y = 2.5e^{6x}$  is  $6 \times 2.5e^{6x} = 15e^{6x}$   
 When  $x = 5$ , the gradient is  $15e^{6 \times 5} = 15e^{30}$   
 (b) When  $x = \frac{1}{3}$ , the gradient is  $15e^{6 \times \frac{1}{3}} = 15e^2$

**E.g. 2** Find the gradient of the curve  $y = 6e^{8x}$  when:

(a)  $x = 0$  (b)  $x = 4$ . Leave your answers in exact form.

**Working:** (a) The gradient of the curve  $y = 6e^{8x}$  is  $8 \times 6e^{8x} = 48e^{8x}$   
 When  $x = 0$ , the gradient is  $48e^{6 \times 0} = 48$  since  $e^0 = 1$   
 (b) When  $x = 4$ , the gradient is  $48e^{6 \times 4} = 48e^{24}$

Video: [Exponential functions](#)  
 Video: [e^x](#)

[Solutions to Starter and E.g.s](#)

### Exercise

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