15. $\frac{C^5D^4D^{-3}}{D^{-2}C^1C^{-3}D^4} = C^5D^4D^{-3}D^2C^{-1}C^3D^{-4} =$

$C^{5+(-1)+3}D^{4+(-3)+2+(-4)} =$

$C^7D^{-1} =$ or $\frac{C^7}{D}$

16. $2\times10^4 + 5\times10^1 + 6\times10^{-1} + 9\times10^{-2} =$

$20\,000 + 50 + 0{,}6 + 0{,}09 = 20\,050{,}69$

17. $3(N) + 6(N+2) = 8(N+4) - 14$

18. $3(N) + 6(N+2) = 8(N+4) - 14$

$3N + 6N + 12 = 8N + 32 - 14$

$3N + 6N - 8N = 32 - 14 - 12$

$N = 6$

6; 8; 10

19. $Tw + T = 11$

$.20Tw + .10T = 1.80$

$(.20Tw + .10T = 1.80)(100) \Rightarrow \quad 20Tw + 10T = 180$

$(Tw + T = 11)(-10) \Rightarrow \quad -10Tw - 10T = -110$

$10Tw = 70$

$Tw = 7$

$Tw + T = 11 \Rightarrow \quad (7) + T = 11$

$T = 4$

20. $Y - X = 0 \Rightarrow Y = X$

$Y - 3X = -4 \Rightarrow \quad (X) - 3X = -4$

$-2X = -4$

$X = 2$

$Y - X = 0 \Rightarrow \quad Y - (2) = 0$

$Y = 2$

Systematic Review 19E

1. $\frac{1}{7^{-3}} = 7^3$

2. $10^{-7} = \frac{1}{10^7}$

3. $\frac{1}{A^X} = A^{-X}$

4. $8^{-X} = \frac{1}{8^X}$

5. $A^2 \cdot A^{-4} = A^{2+(-4)} = A^{-2}$ or $\frac{1}{A^2}$

6. $5^6 \div 5^4 = 5^{6-4} = 5^2$

7. $10^{11} \cdot 10^{-3} \div 10^5 = 10^{11+(-3)-5} = 10^3$

8. $D^2C^{-3}C^{-4}D^8C^2D^{-4} =$

$C^{-3+(-4)+2}D^{2+8+(-4)} = C^{-5}D^6$ or $\frac{D^6}{C^5}$

9. $M^{-X} \cdot M^X = M^{-X+X} = M^0 = 1$

10. $X^{2Y} \div X^{4Y} = X^{2Y-4Y} = X^{-2Y}$ or $\frac{1}{X^{2Y}}$

11. $\left[\left(11^2\right)^5\right]^3 = 11^{2\times5\times3} = 11^{30}$

12. $(49)^3 = \left(7^2\right)^3 = 7^6$

13. $(15)^2 = 15\times15 = 225$

14. $\sqrt{81} = 9$

15. $\frac{X^1Y^2X^4Y^{-1}}{X^{-3}Y^4} = X^1Y^2X^4Y^{-1}X^3Y^{-4} =$

$X^{1+4+3}Y^{2+(-1)+(-4)} = X^8Y^{-3}$ or $\frac{X^8}{Y^3}$

16. $4{,}093 = 4\times10^0 + 9\times10^{-2} + 3\times10^{-3}$

17. $2(N) + 3(N+1) - (N+2) = 21$

18. $2(N) + 3(N+1) - (N+2) = 21$

$2N + 3N + 3 - N - 2 = 21$

$2N + 3N - N = 21 - 3 + 2$

$4N = 20$

$N = 5$

5; 6; 7

19. $Tw + F = 30$

$.20Tw + .05F = 3.60$

$(.20Tw + .05F = 3.60)(100) \Rightarrow \quad 20Tw + 5F = 360$

$(Tw + F = 30)(-5) \Rightarrow \quad -5Tw - 5F = -150$

$15Tw = 210$

$Tw = 14$

$Tw + F = 30 \Rightarrow \quad (14) + F = 30$

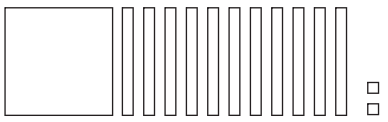
$F = 16$

20. $Y = -2X + 9$

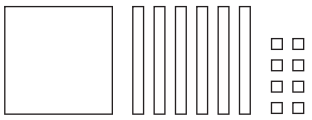
$2X + Y = 9$

Lesson Practice 20A

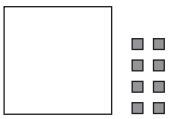
1. $X^2 + 11X + 2$



2. $x^2 + 6x + 8$



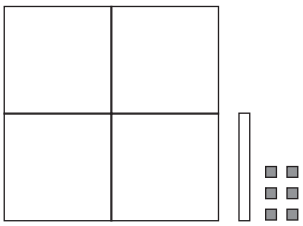
3. $x^2 - 8$



4. $x^2 - 6x + 3$

$3x^2 + 7x - 9$

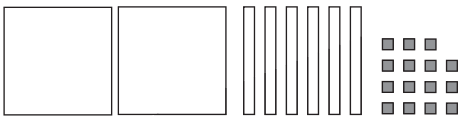
$4x^2 + x - 6$



5. $x^2 \quad -8$

$x^2 + 6x \quad -7$

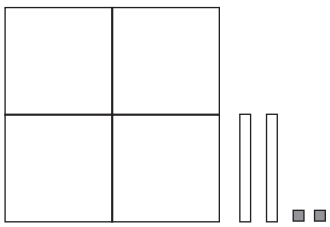
$2x^2 + 6x \quad -15$



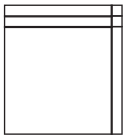
6. $2x^2 + 10x + 7$

$2x^2 \quad -8x - 9$

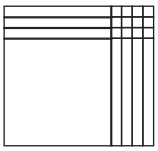
$4x^2 \quad +2x - 2$



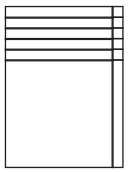
7. $(x+1)(x+2) = x^2 + 3x + 2$



8. $(x+4)(x+3) = x^2 + 7x + 12$



9. $(x+1)(x+5) = x^2 + 6x + 5$



10.

$3x + 2$

$\times x + 1$

$3x + 2$

$3x^2 + 2x$

$3x^2 + 5x + 2$

11.

$5x + 5$

$\times x + 2$

$10x + 10$

$5x^2 + 5x$

$5x^2 + 15x + 10$

12.

$2x + 1$

$\times x + 5$

$10x + 5$

$2x^2 + x$

$2x^2 + 11x + 5$

13.

$x + 8$

$\times 3x + 5$

$5x + 40$

$3x^2 + 24x$

$3x^2 + 29x + 40$

14.

$x + 3$

$\times 2x + 1$

$x + 3$

$2x^2 + 6x$

$2x^2 + 7x + 3$

15.

$3x + 2$

$\times 2x + 1$

$3x + 2$

$6x^2 + 4x$

$6x^2 + 7x + 2$

16.

$4x + 2$

$\times x + 3$

$12x + 6$

$4x^2 + 2x$

$4x^2 + 14x + 6$

17.

$2x - 5$

$\times x + 2$

$4x - 10$

$2x^2 - 5x$

$2x^2 - x - 10$

18.

$3x + 5$

$\times 3x - 1$

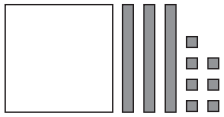
$-3x - 5$

$9x^2 + 15x$

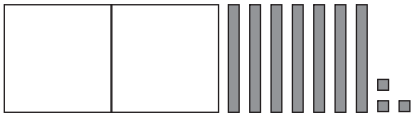
$9x^2 + 12x - 5$

Lesson Practice 20B

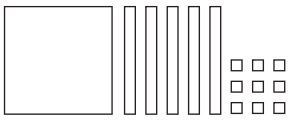
1. $X^2 - 3X - 7$



2. $2X^2 - 7X - 3$



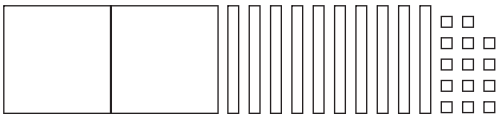
3. $X^2 + 5X + 9$



4. $X^2 + 3X + 2$

$X^2 + 7X + 12$

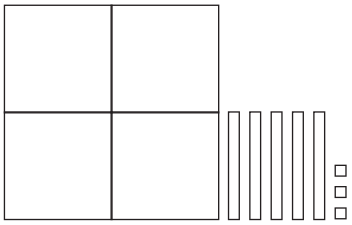
$2X^2 + 10X + 14$



5. $X^2 + 6X + 5$

$3X^2 - X - 2$

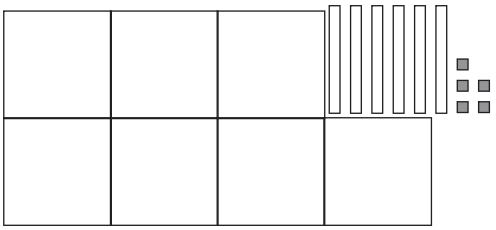
$4X^2 + 5X + 3$



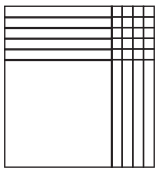
6. $5X^2 - 5X - 10$

$2X^2 + 11X + 5$

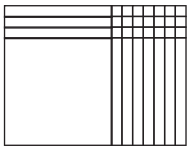
$7X^2 + 6X - 5$



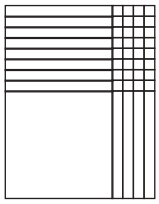
7. $(X + 4)(X + 5) = X^2 + 9X + 20$



8. $(X + 7)(X + 3) = X^2 + 10X + 21$



9. $(X + 4)(X + 8) = X^2 + 12X + 32$



10.

$7X + 1$

$\times\ X + 2$

$14X + 2$

$7X^2 + X$

$7X^2 + 15X + 2$

11.

$3X + 7$

$\times\ X + 6$

$18X + 42$

$3X^2 + 7X$

$3X^2 + 25X + 42$

12.

$2X + 8$

$\times\ 3X + 1$

$2X + 8$

$6X^2 + 24X$

$6X^2 + 26X + 8$

13.

$X + 8$

$\times\ X - 3$

$-3X - 24$

$X^2 + 8X$

$X^2 + 5X - 24$

14.

$2X - 1$

$\times\ X + 9$

$18X - 9$

$2X^2 - X$

$2X^2 + 17X - 9$

15.

$3X + 5$

$\times\ X + 2$

$6X + 10$

$3X^2 + 5X$

$3X^2 + 11X + 10$

16.

$4X - 2$

$\times\ X - 3$

$-12X + 6$

$4X^2 - 2X$

$4X^2 - 14X + 6$

17.

$5X + 2$

$\times\ 3X - 3$

$-15X - 6$

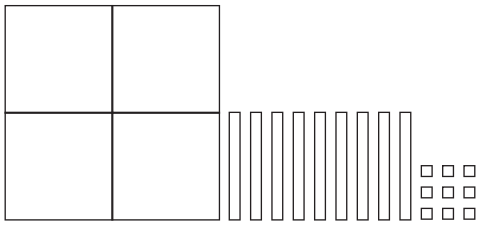
$15X^2 + 6X$

$15X^2 - 9X - 6$

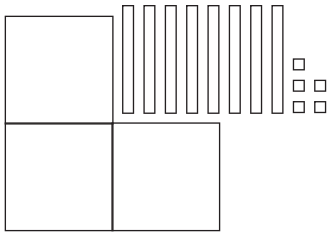
18.
$$\begin{array}{r} 3X+7 \\ \times\ 4X+2 \\ \hline 6X+14 \\ 12X^2+28X \\ \hline 12X^2+34X+14 \end{array}$$

Systematic Review 20C

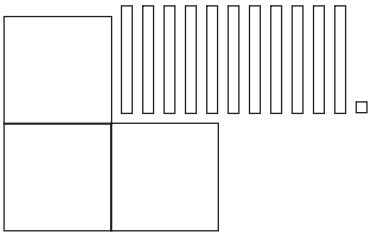
1.
$$\begin{array}{r} 3X^2+7X+6 \\ X^2+2X+3 \\ \hline 4X^2+9X+9 \end{array}$$



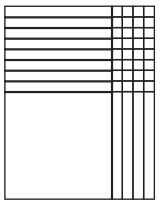
2.
$$\begin{array}{r} 2X^2+5X+1 \\ X^2+3X+4 \\ \hline 3X^2+8X+5 \end{array}$$



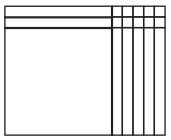
3.
$$\begin{array}{r} 4X^2+8X+2 \\ -X^2+3X-1 \\ \hline 3X^2+11X+1 \end{array}$$



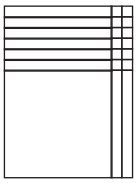
4. $(X+4)(X+8)=X^2+12X+32$



5. $(X+5)(X+2)=X^2+7X+10$



6. $(X+2)(X+6)=X^2+8X+12$



7.
$$\begin{array}{r} 3X+6 \\ \times\ X+2 \\ \hline 6X+12 \\ 3X^2+6X \\ \hline 3X^2+12X+12 \end{array}$$

8.
$$\begin{array}{r} 2X+5 \\ \times\ X+3 \\ \hline 6X+15 \\ 2X^2+5X \\ \hline 2X^2+11X+15 \end{array}$$

9.
$$\begin{array}{r} 4X-5 \\ \times\ X+1 \\ \hline 4X-5 \\ 4X^2-5X \\ \hline 4X^2-X-5 \end{array}$$

10. $\dfrac{1}{X^{-4}}=X^4$

11. $X^{-3}=\dfrac{1}{X^3}$

12. $5^2\times3^0\times5^{-4}=5^{2+(-4)}\times1=5^{-2}$

13. $A^4\div A^7=A^{4-7}=A^{-3}$ or $\dfrac{1}{A^3}$

14. $(5^2)^5 = 5^{2\times5} = 5^{10}$

15. $(5)^{12} = (5)^{3\times4} = (5^3)^4$

16. $\sqrt{196} = 14$

17. $C^{-5} \times C^2 = C^{-5+2} = C^{-3}$ or $\frac{1}{C^3}$

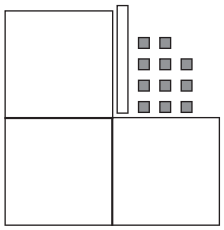
18.
$$\begin{array}{r} X+4 \\ \times\ X+5 \\ \hline 5X+20 \end{array}$$
$$\begin{array}{r} X^2+4X \\ \hline X^2+9X+20 \end{array}$$

19. $A = X^2+9X+20 = (6)^2+9(6)+20 =$
$36+54+20 = 110$ square units

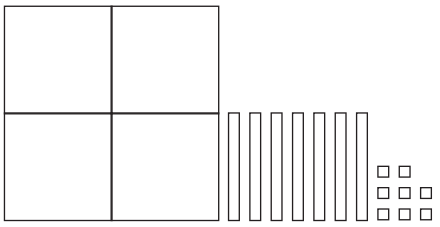
20. $(X+4)(2) \Rightarrow$
$(X+5)(2) \Rightarrow$
$$\begin{array}{r} 2X+8 \\ \times\ 2X+10 \\ \hline 20X+80 \end{array}$$
$$\begin{array}{r} 4X^2+16X \\ \hline 4X^2+36X+80 \end{array}$$

Systematic Review 20D

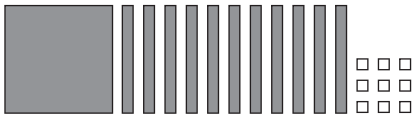
1.
$$\begin{array}{r} X^2-3X-7 \\ 2X^2+4X-4 \\ \hline 3X^2+X-11 \end{array}$$



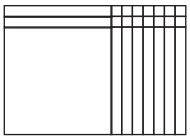
2.
$$\begin{array}{r} X^2+11X+2 \\ 3X^2-4X+6 \\ \hline 4X^2+7X+8 \end{array}$$



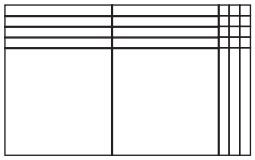
3.
$$\begin{array}{r} X^2-10X-5 \\ -2X^2-X+14 \\ \hline -X^2-11X+9 \end{array}$$



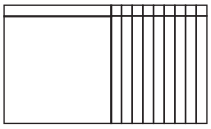
4. $(X+2)(X+7) = X^2+9X+14$



5. $(2X+3)(X+4) = 2X^2+11X+12$



6. $(X+1)(X+9) = X^2+10X+9$



7.
$$\begin{array}{r} 2X+4 \\ \times\ X+3 \\ \hline 6X+12 \end{array}$$
$$\begin{array}{r} 2X^2+4X \\ \hline 2X^2+10X+12 \end{array}$$

8.
$$\begin{array}{r} 3X-1 \\ \times\ X+4 \\ \hline 12X-4 \end{array}$$
$$\begin{array}{r} 3X^2-X \\ \hline 3X^2+11X-4 \end{array}$$

9.
$$\begin{array}{r} 2X-3 \\ \times\ X-4 \\ \hline -8X+12 \end{array}$$
$$\begin{array}{r} 2X^2-3X \\ \hline 2X^2-11X+12 \end{array}$$

10. $\frac{1}{X^4} = X^{-4}$

11. $\frac{1}{Y^{-5}} = Y^5$

12. $3^7 \times 4^3 \times 4^{-2} = 3^7 4^{3+(-2)} =$
$3^7 4^1$ or $3^7 \times 4$

13. $B^5 \div B^1 = B^{5-1} = B^4$

14. $\left(8^3\right)^6 = 8^{3\times 6} = 8^{18}$

15. $(2)^{15} = (2)^{3\times 5} = \left(2^3\right)^5$

16. $\sqrt{225} = 15$

17. $D^{-3} \times D^8 \times D^{-7} = D^{-3+8+(-7)} =$
D^{-2} or $\frac{1}{D^2}$

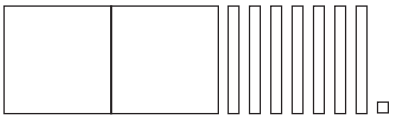
18.
$$\begin{array}{r} 2X + 4 \\ \times\ X + 4 \\ \hline 8X + 16 \end{array}$$
$$\begin{array}{r} 2X^2 + 4X \\ \hline 2X^2 + 12X + 16 \end{array}$$

19. $A = 2X^2 + 12X + 16 =$
$2(10)^2 + 12(10) + 16 =$
$2(100) + 120 + 16 =$
$200 + 120 + 16 = 336$ square units

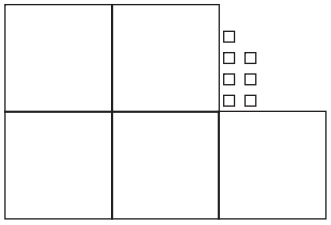
20.
$$\begin{array}{r} 2X^2 + 12X + 16 \\ X^2 + 3X + 1 \\ \hline 3X^2 + 15X + 17 \end{array}$$

Systematic Review 20E

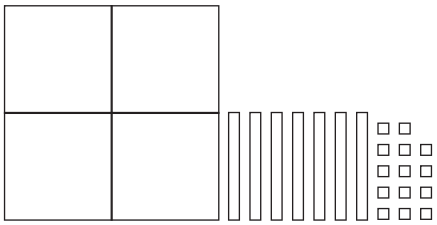
1.
$$\begin{array}{r} X^2 + 3X - 2 \\ X^2 + 4X + 3 \\ \hline 2X^2 + 7X + 1 \end{array}$$



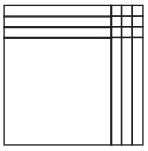
2.
$$\begin{array}{r} 3X^2 + 2X - 1 \\ 2X^2 - 2X + 8 \\ \hline 5X^2 \qquad + 7 \end{array}$$



3.
$$\begin{array}{r} 5X^2 + 4X + 7 \\ -X^2 + 3X + 7 \\ \hline 4X^2 + 7X + 14 \end{array}$$

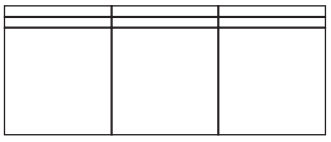


4. $(X+3)(X+3) = X^2 + 6X + 9$



5. $(2X+4)(X+2) = 2X^2 + 8X + 8$

6. $(3X)(X+2) = 3X^2 + 6X$



7.
$$\begin{array}{r} 2X - 3 \\ \times\ X - 2 \\ \hline -4X + 6 \end{array}$$
$$\begin{array}{r} 2X^2 - 3X \\ \hline 2X^2 - 7X + 6 \end{array}$$

8.
$$\begin{array}{r} X-1 \\ \times\ X-6 \\ \hline -6X+6 \\ X^2-X \\ \hline X^2-7X+6 \end{array}$$

9.
$$\begin{array}{r} 2X+2 \\ \times\ X-3 \\ \hline -6X-6 \\ 2X^2+2X \\ \hline 2X^2-4X-6 \end{array}$$

10. $\frac{1}{X^5} = X^{-5}$

11. $Y^{-2} = \frac{1}{Y^2}$

12. $7^{-2} \times 7^5 \div 7^{-2} = 7^{-2+5-(-2)} = 7^5$

13. $A^7 \div B^3 = A^7B^{-3}$ or $\frac{A^7}{B^3}$

14. $\left(5^2\right)^5 = 5^{2\times5} = 5^{10}$

15. $(5)^{12} = (5)^{3\times4} = \left(5^3\right)^4$

16. $-\sqrt{169} = -13$

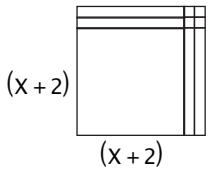
17. $C^0C^{-4}D^8D^{-7}D^{-3}C^3 =$
$C^{0+(-4)+3}D^{8+(-7)+(-3)} =$
$C^{-1}D^{-2}$ or $\frac{1}{CD^2}$

18.
$$\begin{array}{r} 3N+4 \\ +2N+5 \\ \hline 5N+9 \end{array}$$

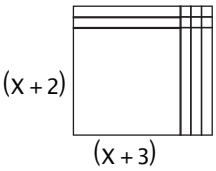
19. $5N+9 = 5(10)+9 = 50+9 = 59$

20.
$$\begin{array}{r} 2Y+7 \\ \times\ 7Y+5 \\ \hline 10Y+35 \\ 14Y^2+49Y \\ \hline 14Y^2+59Y+35 \end{array}$$

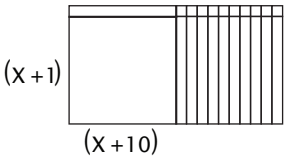
Lesson Practice 21A

1.


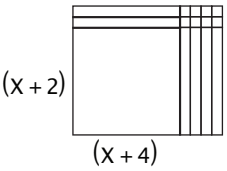
$$\begin{array}{r} X+2 \\ \times X+2 \\ \hline 2X+4 \\ X^2+2X \\ \hline X^2+4X+4 \end{array}$$

2.


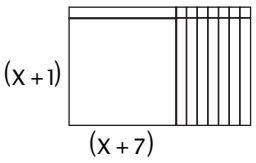
$$\begin{array}{r} X+3 \\ \times X+2 \\ \hline 2X+6 \\ X^2+3X \\ \hline X^2+5X+6 \end{array}$$

3.


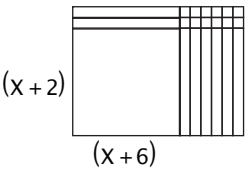
$$\begin{array}{r} X+10 \\ \times X+1 \\ \hline X+10 \\ X^2+10X \\ \hline X^2+11X+10 \end{array}$$

4.


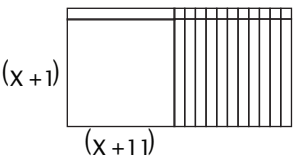
$$\begin{array}{r} X+4 \\ \times X+2 \\ \hline 2X+8 \\ X^2+4X \\ \hline X^2+6X+8 \end{array}$$

5.


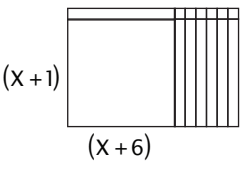
$$\begin{array}{r} X+7 \\ \times X+1 \\ \hline X+7 \\ X^2+7X \\ \hline X^2+8X+7 \end{array}$$

6.


$$\begin{array}{r} X+6 \\ \times X+2 \\ \hline 2X+12 \\ X^2+6X \\ \hline X^2+8X+12 \end{array}$$

7.


$$\begin{array}{r} X+11 \\ \times X+1 \\ \hline X+11 \\ X^2+11X \\ \hline X^2+12X+11 \end{array}$$

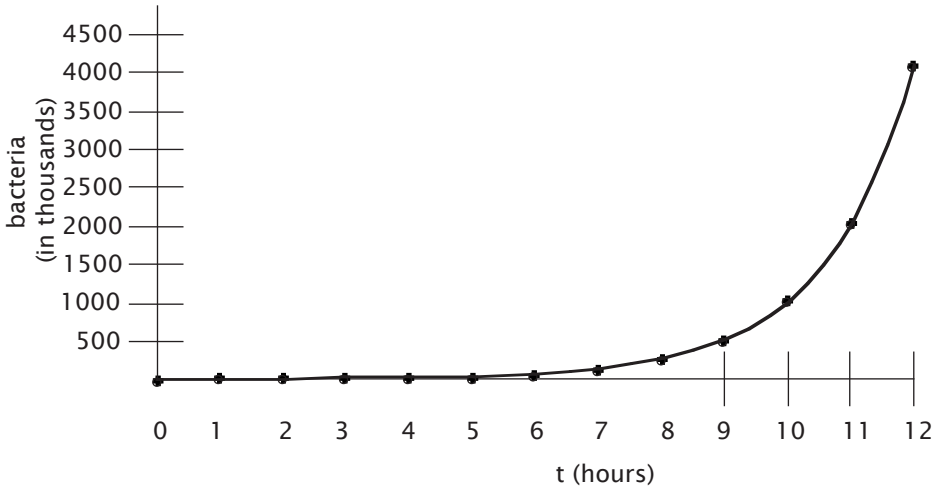
8.


$$\begin{array}{r} X+6 \\ \times X+1 \\ \hline X+6 \\ X^2+6X \\ \hline X^2+7X+6 \end{array}$$

3.

t (hours)	0	1	2	3	4	5	6	7	8	9	10	11	12
b (bacteria in thousands)	1	2	4	8	16	32	64	128	256	512	1024	2048	4096

4.



5. The rate of increase increases over time.

Honours Lesson 20H

1.

x (no. of months)	0	1	2	3	4
m (mass in grams)	200	100	50	25	12,5

2. 200 g

3. 1 month

4. 2 months

5. 12,5 g

6. see graph

7. $m = 200(0{,}5)^x$