1. **(a)** Two points on Marvin's ride are $(2,7,)$ and $(1,1)$. So $m = \dfrac{1-7}{1-2} = 6$. Hence $y = 6x + C$. $(1,1)$ lies on this line, so $1 = 6 + C \Rightarrow C = -5$, so $y = 6x - 5$ is the equation of Marvin's ride.

   (b) If Charlie's ride is parallel to Marvin's then the slope of Charlie's line must also be $m = 6$, and $y = 6x + C$. Charlie starts at $(2,5)$, so $5 = 6 \times 2 + C \Rightarrow C = -7$ and $y = 6x - 7$.
   To find where Charlie crosses the train track we must solve his equation and the train's equation simultaneously. $y = 6x - 7$ and $y = 3x - 2$. The LHSs equal each other so the RHSs must too. So $6x - 7 = 3x - 2$, so $x = \dfrac{5}{3}$ and $y = 3$. So Charlie crosses the railway track at $(\frac{5}{3}, 3)$.

2. **(a)** $x^2 + y^2 = 4^2 \Rightarrow x^2 + y^2 = 16$.

   (b) $(2\sqrt{2})^2 + (2\sqrt{2})^2 = 4 \times 2 + 4 \times 2 = 16$. Therefore $(2\sqrt{2}, 2\sqrt{2})$ lies on this circle.

   (c) $x^2 + (\sqrt{7})^2 = 16 \Rightarrow x^2 + 7 = 16 \Rightarrow x^2 = 9 \Rightarrow x = \pm 3$

3. Let F be the final amount he needs, I be the amount he has to invest, r be the interest rate and t be the number of years. Then $F = Ie^{rt}$ so $e^{rt} = \frac{F}{I}$, so $rt = \ln \frac{F}{I}$, and $t = \left(\ln \frac{F}{I}\right) \div r$. Then

$$\begin{aligned} t &= \left(\ln \frac{1740}{600}\right) \div 0.06 \\ &= (\ln 2.90) \div 0.06 \\ &\approx 1.06 \div 0.06 \\ &\approx 17.75 \end{aligned}$$

   Hence he needs to invest \$600 for approximately 17.75 years. Therefore Damien can marry Celeste when he is about 37 years old.

4. (a) $\log_{15} 15^{13} = 13$

   (b) $4 = 4^1$, so $\log_4 4 = 1$

   (c) $\dfrac{1}{5} = 5^{-1}$, so $\log_5 \dfrac{1}{5} = \log_5 5^{-1} = -1$. Hence the answer is -1.

   (d) $10000 = 10^4$, so $\log_{10} 10000 = 4$

   (e) $\dfrac{1}{10} = 10^{-1}$, so $\log_{10} \dfrac{1}{10} = -1$

   (f) $e = e^1$, so $\ln e = 1$

   (g) $\dfrac{1}{e^{19}} = e^{-19}$, so $\ln \dfrac{1}{e^{19}} = \ln e^{-19} = -19$. Hence the answer is -19.

   (h) $4 = 16^{\frac{1}{2}}$, so $\log_{16} 4 = \dfrac{1}{2}$