

SEPTEMBER 2018 HIGHER TIER SOLUTIONS

1<sup>st</sup>/2<sup>nd</sup>

(a)  $x \leq 3$

(b)  $4x - 2 > 2x - 7$

$2x - 2 > -7$

$2x > -5$

$x > -5/2$

(c)  $-2, -1, 0, 1, 2, 3$

3<sup>rd</sup>

$r = \frac{3m^2 - 5}{n}$

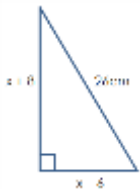
$rn = 3m^2 - 5$

$rn + 5 = 3m^2$

$\frac{rn+5}{3} = m^2$

$\pm \sqrt{\frac{rn+5}{3}} = m$

4<sup>th</sup>



$(x + 8)^2 + (x - 6)^2 = 26^2$

$x^2 + 16x + 64 + x^2 - 12x + 36 = 676$

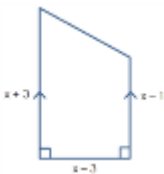
$2x^2 + 4x - 576 = 0$

$x^2 + 2x - 288 = 0$

$(x + 18)(x - 16) = 0$

$x$  is a length so cannot be negative, so  $x = 16$ cm.

5<sup>th</sup>



$\frac{1}{2}[(x + 3) + (x - 1)](x - 3) = 77$

$(2x + 2)(x - 3) = 154$

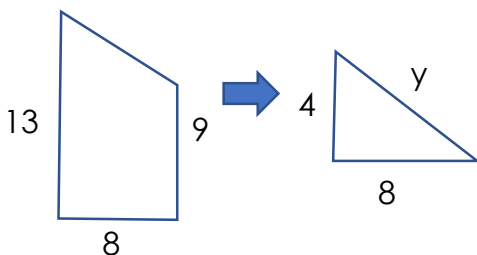
$2x^2 - 4x - 6 = 154$

$x^2 - 2x - 80 = 0$

$(x - 10)(x + 8) = 0$

$x$  must be positive so  $x = 10$ cm.

To find slanted side



$4^2 + 8^2 = y^2$

$80 = y^2$

$y = 8.94$ cm (2dp)

Perimeter =  $11 + 5 + 7 + 8.94 = 31.94$ cm

6<sup>th</sup>

(a)  $y \propto x^3$

$y = kx^3$

$576 = 64k$

$k = 9$

$y = 9x^3$

(b)  $y = 9x^3$

$30.375 = 9x^3$

$3.375 = x^3$

$x = 1.5$

7<sup>th</sup>

$$\begin{aligned}
 \text{(a)} \quad & 5(3x - 2) = 2x + 3 \\
 & 15x - 10 = 2x + 3 \\
 & 13x - 10 = 3 \\
 & 13x = 13 \\
 & x = 1
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad & 7x^2 - 13 = 99 \\
 & 7x^2 = 112 \\
 & x^2 = 16 \\
 & x = \pm 4
 \end{aligned}$$

$$\begin{aligned}
 \text{(c)} \quad & x^2 + 9x - 36 = 0 \\
 & (x + 12)(x - 3) = 0 \\
 & x = -12, x = 3
 \end{aligned}$$

8<sup>th</sup>/9<sup>th</sup>

Completing the square

$$\begin{aligned}
 y &= 4x^2 - 8x - 5 \\
 y &= 4(x^2 - 2x) - 5 \\
 y &= 4[(x - 1)^2 - 1] - 5 \\
 y &= 4(x - 1)^2 - 9
 \end{aligned}$$

Solving the equation

$$\begin{aligned}
 4x^2 - 8x - 5 &= 0 \\
 (2x + 1)(2x - 5) &= 0 \\
 x &= -\frac{1}{2} \text{ and } x = \frac{5}{2}
 \end{aligned}$$

A(-1/2, 0)    B(0, -5)    C(1, -9)    D(5/2, 0)

10<sup>th</sup>

$$\begin{aligned}
 6x^2 - 4x = 5 \quad & 6x^2 - 4x - 5 = 0 \quad a = 6, b = -4, c = -5 \\
 x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(6)(-5)}}{2(6)} \quad & x = \frac{4 \pm \sqrt{16 - 120}}{12} \quad x = \frac{4 \pm \sqrt{136}}{12} \quad x = 1.31 \text{ and } x = -0.64
 \end{aligned}$$

11<sup>th</sup>

$$\begin{aligned}
 \text{(a)} \quad & 5\frac{2}{3} - 2\frac{3}{4} \\
 & \frac{17}{3} - \frac{11}{4} \\
 & \frac{68}{68} - \frac{33}{33} \\
 & \frac{12}{12} - \frac{12}{12} \\
 & \frac{35}{12} = 2\frac{11}{12}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad & 2\frac{2}{5} \div 1\frac{2}{9} \\
 & \frac{12}{5} \div \frac{11}{9} \\
 & \frac{12}{5} \times \frac{9}{11} \\
 & \frac{108}{55} = 1\frac{53}{55}
 \end{aligned}$$

12<sup>th</sup>

$$\begin{aligned}
 \text{(a)} \quad & 0.000907 = 9.07 \times 10^{-4} \quad \text{(b)} \quad 5.821 \times 10^3 = 5821 \\
 \text{(c)} \quad & \frac{(4.1 \times 10^{-2}) \times (3.8 \times 10^4)}{9.11 \times 10^{-2}} = 17102.08562 = 17100 \text{ to 3 s.f.}
 \end{aligned}$$

13<sup>th</sup>

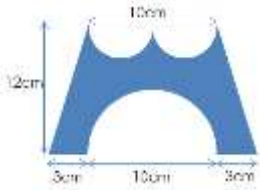
$y = ab^x$

$$\begin{aligned}
 12 &= ab \quad (1) \quad & 972 &= ab^5 \quad (2) \\
 (2) \div (1) \quad & 81 &= b^4 \quad & b = 3 \quad & a = 4
 \end{aligned}$$

14<sup>th</sup>

$$1.3 \times 0.9 \times 0.8 = 0.936 = 93.6\% \text{ Reduction of } 6.4\%$$

15<sup>th</sup>/16<sup>th</sup>



Area of trapezium =  $\frac{1}{2} \times 12 \times (16 + 10) = 156\text{cm}^2$   
 Area of semi-circles =  $(\pi \times 2.5^2) + \frac{1}{2} (\pi \times 5^2) = 18.75\pi$   
 Shaded area =  $156 - 18.75\pi = 97.10\text{cm}^2$  (4 s.f.)

17<sup>th</sup>

$$\begin{aligned} 5x - 3y &= 26 & (1) & & 3x + 4y &= 4 & (2) \\ (1) \times 3 & 15x - 9y = 78 & (3) & & & & \\ (2) \times 5 & 15x + 20y = 20 & (4) & & & & \\ (4) - (3) & & 29y = -58 & & y = -2 & & \\ \text{Sub } y = -2 & \text{ into (2)} & & & & & \\ 3x - 8 &= 4 & & & 3x = 12 & & x = 4 \end{aligned}$$

18<sup>th</sup>

Pittsborough  $? \times 1.08 = 18576$  Population 5yrs ago =  $18576 \div 1.08 = 17200$   
 Bramallville  $? \times 1.15 = 18975$  Population 5yrs ago =  $18975 \div 1.15 = 16500$   
 In the last 5 years the population of Pittsborough increased by 1376 and the population of Bramallville increased by 2475.

19<sup>th</sup>

$$(3n + 5)^2 - (3n - 5)^2$$

$$9n^2 + 30n + 25 - (9n^2 - 30n + 25) = 60n = 6(10n) \text{ therefore a multiple of 6 for all } n.$$

20<sup>th</sup>

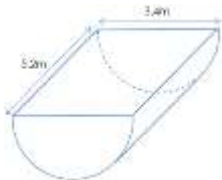
$$\frac{x + 7}{3x - 2} = \frac{(x + 7)(3x + 2)}{(3x - 2)(3x + 2)} = \frac{3x^2 + 23x + 14}{9x^2 - 4}$$

$a = 3, b = 23, c = 14, d = 9$

21<sup>st</sup>

Dimensions of rectangle are  $x$  and  $x + 5$  Perimeter =  $4x + 10$   
 Dimensions of triangle is  $2x$  Perimeter =  $6x$   
 $4x + 10 = 6x$   $10 = 2x$   $x = 2\text{cm}$  Rectangle area =  $2 \times 7 = 14\text{cm}^2$ .

22<sup>nd</sup>/23<sup>rd</sup>



Volume =  $\frac{1}{2} \times (\pi \times 1.7^2) \times 5.2 = 7.514\pi \text{ m}^3 = 7514\pi \text{ litres}$   
 90% capacity =  $0.9 \times 7514\pi = 6762.6\pi \text{ litres}$   
 Time =  $6762.6\pi \div 10 = 2124.5 \text{ minutes} = 35 \text{ hours } 25 \text{ minutes}$

24<sup>th</sup>

(a)  $400 \times 22 = 8800 \div 50 = 176$  50 peso notes  
 (b)  $1105 \div 19.5 = \text{£}56.67$

25<sup>th</sup>

Gradient of  $L_1 = 2$

$$L_2: y = -\frac{1}{2}x + c$$

$$L_2: y = -\frac{1}{2}x + 5$$

Gradient of  $L_2 = -\frac{1}{2}$

Goes through  $(4, 3)$

$$3 = -\frac{1}{2}(4) + c$$

$$c = 5$$

26<sup>th</sup>

$$m \propto \frac{1}{\sqrt{n}}$$

$$m = \frac{k}{\sqrt{n}}$$

$$0.8 = \frac{k}{10} \quad k = 8$$

$$m = \frac{8}{\sqrt{n}}$$

$$40 = \frac{8}{\sqrt{n}}$$

$$\sqrt{n} = \frac{8}{40} = \frac{1}{5}$$

$$n = \frac{1}{25}$$

27<sup>th</sup>

(a) Reciprocal of  $6.25 = \frac{1}{6.25} = \frac{4}{25}$  (0.16)

(b)  $\frac{12.2 - \sqrt{33.6}}{\sqrt{42} - 4.1} = 2.689687838 = 2.69$  to 3 s.f.

28<sup>th</sup>

$$x^2 + 5x - 4 = 3 - x$$

A:  $x = -7$  and  $y = 10$

$$x^2 + 6x - 7 = 0$$

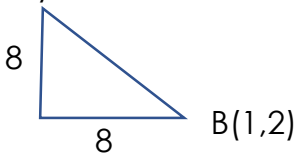
$$(x + 7)(x - 1) = 0$$

B:  $x = 1$  and  $y = 2$

$$AB^2 = 8^2 + 8^2 = 128$$

$$AB = \sqrt{128} = 8\sqrt{2}$$

A(-7,10)



29<sup>th</sup>/30<sup>th</sup>



$$\text{Area} = \frac{75}{360} \times \pi \times 6.4^2 = \frac{128}{15} \pi \text{ m}^2$$

$$\text{Bags needed} = \frac{128}{15} \pi \div 2.5 = 10.7 = 11 \text{ bags}$$

$$\text{Cost Before VAT} = 11 \times 6.99 = \text{£}76.89$$

$$\text{After Discount} = \text{£}76.89 \times 0.85 = \text{£}65.36$$

$$\text{Including VAT} = \text{£}65.36 \times 1.2 = \text{£}78.43$$