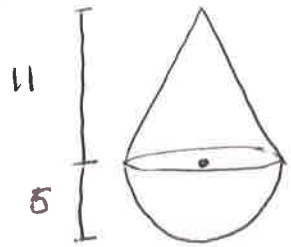
N5 Unit 2 Solutions

Volume and Surface Area

Q1



$V_{cone} = \frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \pi \times 5^2 \times 11$

$= 287.979...$

$V_{hemi\text{-}sphere} = \frac{4}{3}\pi r^3 \div 2$

$= \frac{4}{3} \times \pi \times 5^3 \div 2$

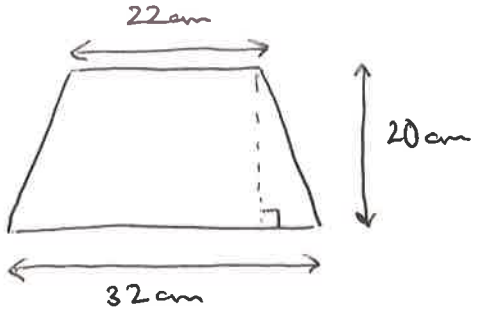
$= 261.799...$

Total volume $= 287.979 + 261.799$

$= 549.778$

$= \underline{550\ cm^3}$ (2 s f)

Q2



$Area = \frac{1}{2} h(a+b)$

$= \frac{1}{2} \times 20 \times (22+32)$

$= \underline{540\ cm^2}$

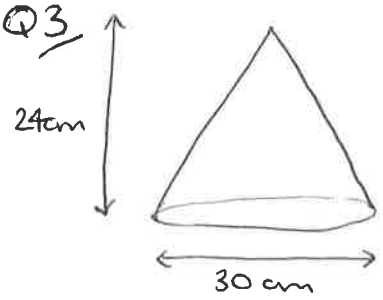
(use formula above or split up into rectangle and identical triangles)

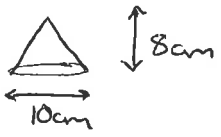
b) $V = Ah$

$= 540 \times 60$

$= \underline{32400\ cm^3}$

Q3





$V_{cone} = \frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \pi \times 5^2 \times 8$

$= 209.439...$

$V_{cone} = \frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \pi \times 15^2 \times 24$

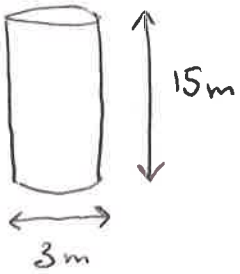
$= 5654.866...$

Volume of water $= 5654.866 - 209.439$

$= 5445.427$

$= 5400 cm^3$ (2 s.f)

Q4



$V_{cylinder} = \pi r^2 h$

$= \pi \times 1.5^2 \times 15$

$= 106.028...$

$= 106.03 m^3$ 2dp

b)

$V_{cone} = 5.7 m^3 = \frac{1}{3}\pi r^2 h$

So, $\frac{1}{3} \times \pi \times 1.5^2 \times h = 5.7$

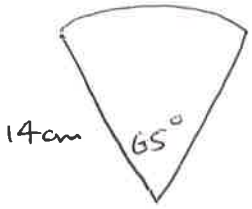
(×3) $\pi \times 1.5^2 \times h = 17.1$

(÷ 1.5^2) $\pi \times h = 7.6$

(÷ π) $h = 2.419...$

$= 2.42$ m

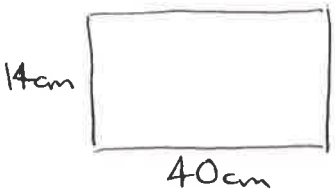
Q5



$$\text{Area} = \frac{65}{360} \times \pi r^2$$

$$= \frac{65}{360} \times \pi \times 14^2$$

$$= 111.1774734$$



$$\text{Area} = 14 \times 40$$

$$= 560$$

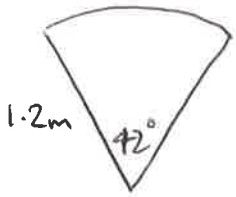
So, total: $(111.177 \times 2) + (560 \times 2)$

$$= 1342.354$$

$$= 1342.35 \text{ cm}^2$$

Circles

Q1



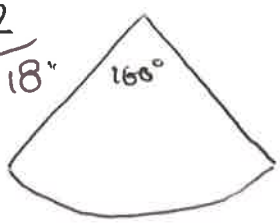
$$\text{Arc} = \frac{42}{360} \times \pi d$$

$$= \frac{42}{360} \times \pi \times 2.4$$

$$= 0.879....$$

The staircase will not pass safety regulations since $0.879 < 0.9$ m

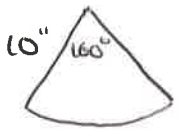
Q2



$$\text{Area} = \frac{160}{360} \times \pi r^2$$

$$= \frac{160}{360} \times \pi \times 18^2$$

$$= 452.389...$$



$$\text{Area} = \frac{160}{360} \times \pi \times 10^2$$

$$= 139.626...$$

Area of collar

$$= 452.389 - 139.626$$

$$= 312.763 \text{ square inch}$$

Q3

The circumference of a circle with radius 50 is (πd)

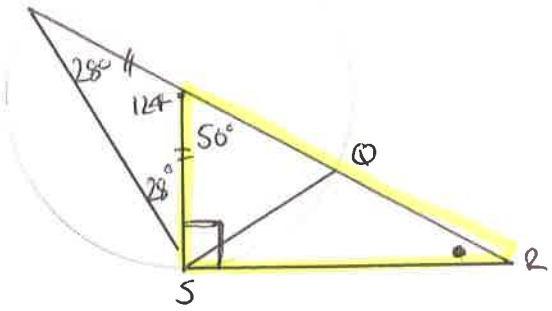
$$\pi \times 100 = 314.159...$$

$$x^\circ = \frac{36.7}{314.159} \times 360^\circ$$

$$= 42.055...$$

$$= 42.1^\circ$$

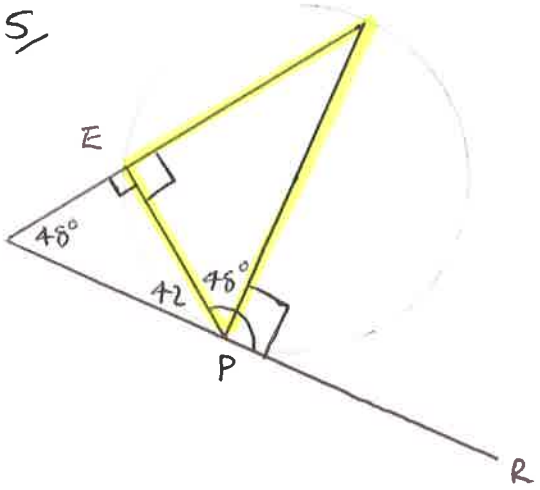
Q4



$\angle QRS = 180 - (90 + 56)$

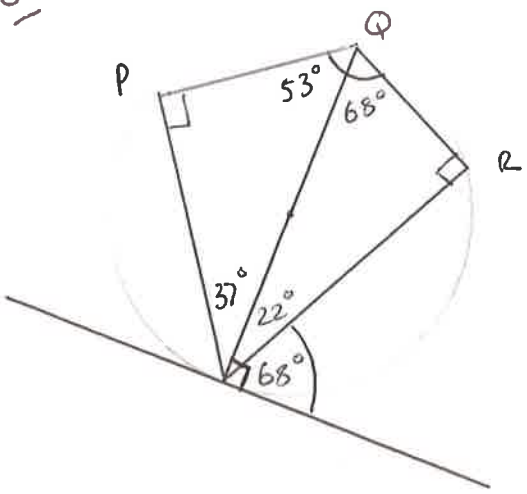
$= 34^\circ$

Q5



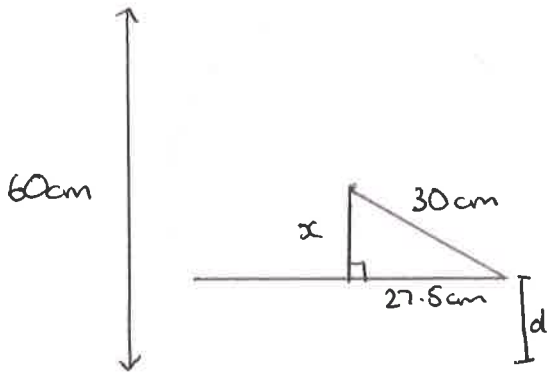
$\angle EPR = 90 + 48 = 138^\circ$

Q6



$\angle PQR = 53 + 68 = 121^\circ$

Q7



$x^2 = 30^2 - 27.5^2$

$x^2 = 143.75$

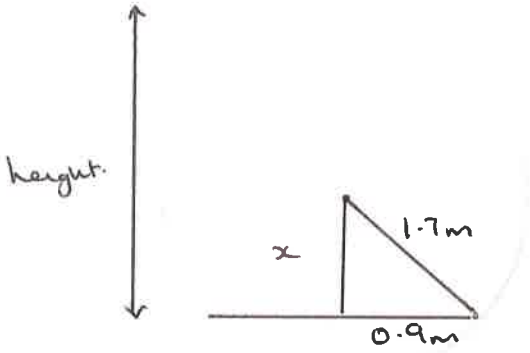
$x = 11.9899...$

$= 11.99$

So, depth $= 30 - 11.99$

$= 18.01$ cm

Q8



$x^2 = 1.7^2 - 0.9^2$

$x^2 = 2.08$

$x = 1.442...$

$= 1.44$

So, height $= 1.7 + 1.44$

$= 3.14$ m

The Straight Line

Q1 $(\overset{x_1}{15}, \overset{y_1}{33})$ $(\overset{x_2}{9}, \overset{y_2}{21})$

Gradient $= \frac{21 - 33}{9 - 15}$

$= \frac{-12}{-6}$

$= 2$

Point $(\overset{a}{9}, \overset{b}{21})$

Eq^n $y - b = m(x - a)$

$y - 21 = 2(x - 9)$

$y - 21 = 2x - 18$

$(+21)$ $y = 2x + 3$

b) $y = 2x + 3$

Sport ← y, x → Film

$y = 2(20) + 3$

$= 43$

Q2

(x_1, y_1) $(0, 1.8)$ (x_2, y_2) $(4, 6.6)$

Gradient $m = \frac{6.6 - 1.8}{4 - 0}$

$= \frac{4.8}{4}$

$= 1.2$

∴ Since we have the y-intercept we can use:

$y = mx + c$

The axes are labelled 'd' and 'f' though!

Eq^n $y = 1.2x + 1.8$

$f = 1.2d + 1.8$

b) $f = 1.2(7) + 1.8$

$= 10.2$

So, the fare is £10.20

Q3 $2x + y = 3$

$(-2x)$ $y = 3 - 2x$

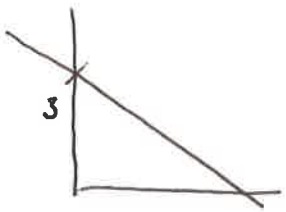
∴ in form $y = mx + c$

y-intercept = 3

gradient = -2

i.e. slopes down.

D



Solving Equations and Inequations

Q1 $4x - 5 \leq 7x - 20$

$(-4x)$ $\quad -5 \leq 3x - 20$

$(+20)$ $\quad 15 \leq 3x$

$(\div 3)$ $\quad 5 \leq x$

$x \geq 5$

Q2 $11 - 2(1 + 3x) < 39$

$11 - 2 - 6x < 39$

$9 - 6x < 39$

(-9) $\quad -6x < 30$

$(\div -6)$ $\quad x > -5$

Q3 $3x + 1 = \dfrac{x - 5}{2}$

$(\times 2)$ $\quad 6x + 2 = x - 5$

$(-x)$ $\quad 5x + 2 = -5$

(-2) $\quad 5x = -7$

$(\div 5)$ $\quad x = -\frac{7}{5}$

Q4 $\dfrac{x}{4} - \dfrac{1}{2} < 5$

$(\times 4)$ $\quad x - 2 < 20$

$(+2)$ $\quad x < 22$

Simultaneous Equations

Q1/ $x + y = 300$ ①

b) $4x + 6y = 1380$ ②

c) ① × 6 $6x + 6y = 1800$ ③ ∞ SSS

② × 1 $4x + 6y = 1380$ ④

③ − ④ $2x = 420$

(÷2) $x = 210$

Subst $x = 210$ in ①

$x + y = 300$

$210 + y = 300$

(−210) $y = 70$

Soln is : there are 210 standard seats (x)

and 70 deluxe seats (y)

Q2 Let a = cost of an adult ticket

Let c = cost of child ticket.

a) $5a + 3c = 158.25$ ①

b) $3a + 2c = 98$ ②

c) ① × 2 $\quad 10a + 6c = 316.5$ ③

② × 3 $\quad 9a + 6c = 294$ ④

③ − ④ $\quad a = 22.5$

Subst $a = 22.5$ in ②

$3a + 2c = 98$

$3(22.5) + 2c = 98$

$67.5 + 2c = 98$

$(-67.5) \quad 2c = 30.5$

$(\div 2) \quad c = 15.25$

Soln is: adult ticket = £22.50

child ticket = £15.25

Q3 a) Need 2 variables (letters), $y = mx + c$ has 4!

Use (2, 7) and (4, 17)

$x \; y$ $\quad x \; y$

a) $7 = 2m + c$ i.e. $2m + c = 7$ ①

b) $17 = 4m + c$ i.e. $4m + c = 17$ ②

c) ② − ① $\quad 2m = 10$

$(\div 2) \quad m = 5$

Subst $m = 5$ in ①

$2m + c = 7$

$2(5) + c = 7$

$10 + c = 7$

$(-10) \quad c = -3$

Soln is $m = 5$, $c = -3$

d) Gradient is 5 i.e. $y = 5x - 3$

Formulae

Q1 $4\pi r^2 = A$

$(\div 4\pi)$ $r^2 = \frac{A}{4\pi}$

$(\sqrt{\ })$ $r = \sqrt{\frac{A}{4\pi}}$

Q2 $L = \frac{\sqrt{m}}{k}$

$(\times k)$ $kL = \sqrt{m}$

$m = (kL)^2$

Q3 $t = \frac{7s+4}{2}$

$(\times 2)$ $2t = 7s + 4$

(-4) $2t - 4 = 7s$

$(\div 7)$ $s = \frac{2t-4}{7}$

Q4 $\frac{mv^2}{2} = p$

$(\times 2)$ $mv^2 = 2p$

$(\div m)$ $v^2 = \frac{2p}{m}$

$v = \sqrt{\frac{2p}{m}}$

Q5 $s = ut + \frac{1}{2}at^2$

$(-ut)$ $\frac{1}{2}at^2 = s - ut$

$(\times 2)$ $at^2 = 2s - 2ut$

$(\div t^2)$ $a = \frac{2s-2ut}{t^2}$

Q6 $P = \frac{2(m-4)}{3}$

$(\times 3)$ $3P = 2(m-4)$

$(\div 2)$ $\frac{3P}{2} = m - 4$

$(+4)$ $m = \frac{3P}{2} + 4$

Statistics

Q1

	Mean	S.D.
Before	20.8	8.5
After	9.6	12.0

On average, fewer cigarettes were smoked per person after the course.

The number of cigarettes smoked per person was more varied after the course.

Q2

a) $\bar{x} = 808 \div 8 = 101$

x	$\bar{x}$	$x - \bar{x}$	$(x - \bar{x})^2$
102	101	1	1
102	101	1	1
101	101	0	0
98	101	-3	9
99	101	-2	4
101	101	0	0
103	101	2	4
102	101	1	1
		$\Sigma =$	20

$$\text{s.d.} = \sqrt{\frac{20}{7}}$$

$$= 1.6903\ldots$$

$$= 1.69$$

b)

	mean	s.d.
Machine 1	101	1.69
Machine 2	103	2.1

On average the second sample has a greater number of pins per box.

The second sample was more varied in the number of pins per box.

Q3 Mean = £372

S.D = £74

Q4 12 16 17 18 18 21 22 26 27 27

Q2 = 19.5

Q1 = 17

Q3 = 26

$$SIQR = \frac{26-17}{2} = \frac{9}{2} = 4.5$$

b)

	mean	range
Round 1	19.5	4.5
Round 2	26	2.5

Median On average the dancers scores were higher in round 2.

SIQR The dancers scores were less spread out in round 2.