

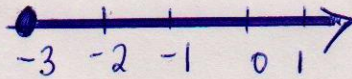
2nd year Higher 2013 SUMMER Solutions

Q1(a) find the solution Set of inequality

NB

$$\begin{aligned} 6 - 2x &\leq 12 & x \in \mathbb{R} \\ -2x &\leq 12 - 6 \\ -2x &\leq 6 \\ +2x &\geq -6 & \text{(Reverse arrow if multiply by -1)} \\ x &\geq \frac{-6}{2} \\ \boxed{x \geq -3} & \text{ answer} \end{aligned}$$

We must put result on number line



heavy line, filled in circle

10 MARKS

(b)(i) express in simplest form (write as single fraction)

$$\begin{aligned} &\frac{2x+1}{6} - \frac{x-2}{8} \\ \Rightarrow & 24 \text{ is our common denominator} \\ & \text{Multiply top and bottom by 4 and 3} \\ & \frac{4(2x+1)}{4(6)} - \frac{3(x-2)}{3(8)} \\ & \frac{8x+4}{24} - \frac{3x-6}{24} \quad \text{(watch signs)} \end{aligned}$$

$$\frac{8x+4-3x+6}{24}$$

$$\frac{5x+10}{24}$$

$$\boxed{\frac{5x+10}{24}} \quad \text{Answer (single fraction)}$$

10 MARKS

(b)(ii) Helen buys stamps costing 48 cent and 60 Cent
She buys a total of 50 stamps costing €25.68

We have two criteria ① total Number of stamps = 50
② total cost of stamps = €25.68

2 equations Required \rightarrow $x = 48 \text{ cent stamps, } y = 60 \text{ Cent stamps}$

$$\boxed{x+y=50} \quad \boxed{0.48x+0.60y=25.68}$$

We need to solve by simultaneous Equations

$$x + y = 50$$

$$0.48x + 0.60y = 25.68 \quad (\times 10 \text{ to get rid of decimals})$$

$$\begin{array}{r} x + y = 50 \\ 48x + 60y = 2568 \end{array} \quad \begin{array}{l} \text{(multiply by)} \\ -48 \text{ or } -60 \end{array}$$

$$-48x - 48y = -2400 \quad (\text{add columns})$$

$$\begin{array}{r} -48x - 48y = -2400 \\ 48x + 60y = 2568 \\ \hline 12y = 168 \end{array}$$

$$12y = 168$$

$$\boxed{y = 14}$$

14 60 cent stamps

$$\text{sub } y = 14$$

$$x + y = 50$$

$$x + 14 = 50$$

$$x = 50 - 14$$

$$\boxed{x = 36}$$

36 48 cent stamps

C(1) Solve, give answers to one decimal place

NB this means we must use $-b$ formula

$$3x^2 + 9x + 10 = (2x + 2)^2 - 1 \quad (\text{simply first})$$

$$3x^2 + 9x + 10 = (2x + 2)(2x + 2) - 1 \quad (\text{multiply brackets first})$$

$$3x^2 + 9x + 10 = 2x(2x + 2) + 2(2x + 2) - 1$$

$$3x^2 + 9x + 10 = 4x^2 + 4x + 4x + 4 - 1$$

$$3x^2 + 9x + 10 = 4x^2 + 4x - 4x - 4 + 1 = 0$$

$$3x^2 - 4x^2 + 9x - 4x - 4x + 10 - 4 + 1 = 0$$

$$-x^2 + x + 7 = 0 \quad (\text{multiply by } -1)$$

$$x^2 - x - 7 = 0 \quad (\text{use } -b \text{ formula})$$

$$\boxed{a = +1 \quad b = -1 \quad c = -7}$$

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-7)}}{2(1)}$$

Sub into brackets

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-7)}}{2(1)}$$

(using calculator)

$$x = \frac{1 \pm \sqrt{29}}{2}$$

(3)

$$x = \frac{(1 + \sqrt{29})}{2} \div 2 \quad (\text{type into Calc this way for accuracy})$$

$$x = 3.19$$

$$\boxed{x = 3.2}$$

$$x = \frac{(1 - \sqrt{29})}{2}$$

$$x = -2.19$$

$$\boxed{x = -2.2} \quad \text{one decimal place.}$$

(c)(iv) Simplify. $(7x-2)(7x+2) - (5y-2)(5y+2)$

multiply brackets separately:

$$7x(7x+2) - 2(7x+2)$$

$$49x^2 + 14x - 14x - 4$$

$$\underline{49x^2 - 4}$$

$$5y(5y+2) - 2(5y+2)$$

$$25y^2 + 10y - 10y - 4$$

$$\underline{25y^2 - 4}$$

use both results

$$(49x^2 - 4) - (25y^2 - 4)$$

$$49x^2 - 4 - 25y^2 + 4$$

$$\boxed{49x^2 - 25y^2}$$

And factorise result

$$\boxed{(7x+5y)(7x-5y)}$$

Answer

(5marks)

using perfect squares

$$\sqrt{49} = 7 \quad \sqrt{25} = 5$$

Q2(a)

$$v^2 = u^2 + 2as$$

(write as $S = \dots$)

$$v^2 - u^2 = 2as$$

(isolate S part on its own)

$$\frac{v^2 - u^2}{2a} = S$$

(divide by $2a$ for S on its own)

(10marks)

$$2a$$

(b)(i) Factorise $3p - c + 3pc - c^2$ (rearrange, using common factor rule)

$$\underbrace{3p + 3pc}_{\text{H.C.F.}} - \underbrace{c - c^2}_{\text{H.C.F.}}$$

$$3p(1+c) - c(1+c)$$

Answer $\boxed{(3p-c)(1+c)}$ (H.C.F. of -1 will give correct signs)

7 marks

(ii) $6x^2 - 19x + 10$ Factorise \rightarrow Guide No. Method

	60	
1	60	
2	30	
-4	-15	✓
6	10	
3	20	

$$\underbrace{6x^2 - 4x}_{\text{H.C.F.}} - \underbrace{15x + 10}_{\text{H.C.F.}}$$

$$2x(3x-2) - 5(3x-2)$$

$$\boxed{(2x-5)(3x-2)}$$
 Answer

(iii) $25x^2 - 36y^2$ Factorise \rightarrow perfect Squares

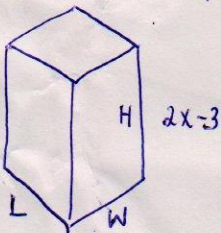
$$\sqrt{25} = 5$$

$$\sqrt{36} = 6$$

$$\boxed{(5x + 6y)(5x - 6y)}$$
 Answer

6 marks

(c) Volume of Cuboid is $2x^3 + 5x^2 - 4x - 12$.



$$L \times W \times H = 2x^3 + 5x^2 - 4x - 12$$

$$L \times W \times (2x-3) = 2x^3 + 5x^2 - 4x - 12$$

We use long division to get $L \times W$.

$$\begin{array}{r} x^2 + 4x + 4 \\ 2x-3 \overline{) 2x^3 + 5x^2 - 4x - 12} \\ \underline{\ominus 2x^2 + 3x^2} \\ 8x^2 - 4x \\ \underline{\ominus 8x^2 + 12x} \\ 8x - 12 \\ \underline{\ominus 8x + 12} \\ 0 \end{array}$$

$$\frac{2x^3}{2x} = x^2$$

$$\frac{8x^2}{2x} = 4x$$

$$\frac{8x}{2x} = 4$$

$\rightarrow D(\div)$

$\rightarrow M(\times)$

\rightarrow Change Signs and add

(1) $x^2 + 4x + 4 = L \times W$ area of base. (5)

(II) factorise $x^2 + 4x + 4$ to get length/width of base

guide no \rightarrow

$$\begin{array}{c}
 x^2 + 4x + 4 \\
 \swarrow \quad \searrow \\
 \textcircled{4} \\
 + 2+2 \quad \checkmark \\
 4 \quad 1
 \end{array}$$

$$\begin{array}{c}
 \underbrace{x^2+2x} + \underbrace{2x+4} \\
 x(x+2) + 2(x+2) \\
 (x+2)(x+2)
 \end{array}$$

So length is $\boxed{x+2}$

(III) if $(x+2)$ is length, $(2x-3)$ is height neither can be negative so x must be greater than $\frac{3}{2}$ so length/height isn't negative overall

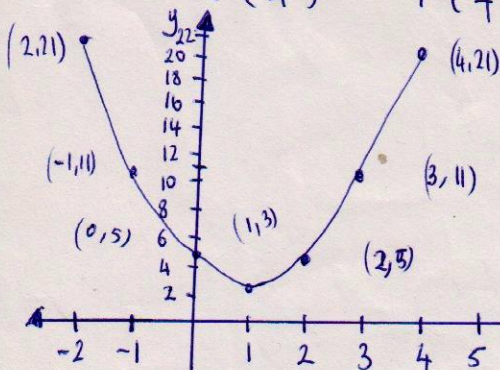
Q3 $f: x \rightarrow 2x^2 - 4x + 5$ draw function $-2 \leq x \leq 4$

Shape will be \cup happy face, $+x^2$

x	y	x, y
$x = -2$	$2(-2)^2 - 4(-2) + 5 = 21$	$(-2, 21)$
$x = -1$	$2(-1)^2 - 4(-1) + 5 = 11$	$(-1, 11)$
$x = 0$	$2(0)^2 - 4(0) + 5 = 5$	$(0, 5)$
$x = 1$	$2(1)^2 - 4(1) + 5 = 3$	$(1, 3)$
$x = 2$	$2(2)^2 - 4(2) + 5 = 5$	$(2, 5)$
$x = 3$	$2(3)^2 - 4(3) + 5 = 11$	$(3, 11)$
$x = 4$	$2(4)^2 - 4(4) + 5 = 21$	$(4, 21)$

use calculator to work out brackets

points 10 marks



Draw a LARGE graph

10 marks graph

$$\begin{aligned} (-1,0) \quad 0 &= 4(-1)^2 + b(-1) + C \\ xy \quad 0 &= 4(1) - b + C \\ 0 &= 4 - b + C \end{aligned}$$

$$\boxed{-4 = -b + C}$$

$$\begin{aligned} (2,6) \quad 6 &= 4(2)^2 + b(2) + C \\ xy \quad 6 &= 4(4) + 2b + C \\ 6 &= 16 + 2b + C \end{aligned}$$

$$\boxed{-10 = 2b + C}$$

Simultaneous equations will find b and C

$$-b + C = -4$$

$$2b + C = -10 \quad (\times \text{ by } -1)$$

$$-b + C = -4$$

$$-2b - C = +10 \quad (\text{now } C \text{ as the same with opp sign})$$

$$-3b = 6$$

$$3b = -6$$

$$\boxed{b = -2}$$

sub $b = -2$ back in

$$2b + C = -10$$

$$2(-2) + C = -10$$

$$C = -10 + 4$$

$$\boxed{C = -6}$$

(ii) finding coordinates of point P.

$$f: x \rightarrow 4x^2 + bx + C$$

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

P is on x axis, solving using guide number finds points on x axis. Remember here $y = 0$.

$$4x^2 - 2x - 6 = 0$$

$$\begin{array}{r} \text{AC method} \\ \text{4} \quad \text{6} \\ \text{1} \quad \text{24} \\ \text{2} \quad \text{12} \\ + \quad \text{4} \quad \text{6} \quad \checkmark \\ \hline \text{3} \quad \text{8} \end{array}$$

$$4x^2 + 4x - 6x - 6 = 0$$

$$4x(x+1) - 6(x+1) = 0$$

$$4x - 6 = 0 \quad x + 1 = 0$$

$$4x = 6 \quad x + 1 = 0$$

$$x = \frac{6}{4} \quad x = -1$$

$$x = 1.5$$

$$\boxed{P \text{ must be } (1.5, 0)}$$

as $(-1, 0)$ is other point given on x axis.

(iii) q cuts the y axis so NB x value = 0.

(8)

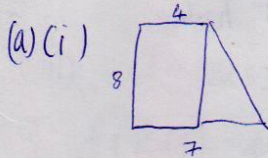
f: x → 4x² - 2x - 6 NB f: x is y part

x=0 y = 4(0)² - 2(0) - 6

y = -6.

⇒ $q = (0, -6)$

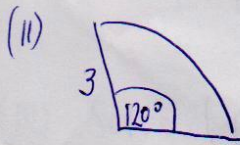
Q4 Find Area of shapes:



Rectangle = L x W
= 4 x 8 = 32

Triangle = 1/2 (base) (height)
= 1/2 (3)(8)
= 12

32 + 12 = 44 total area.

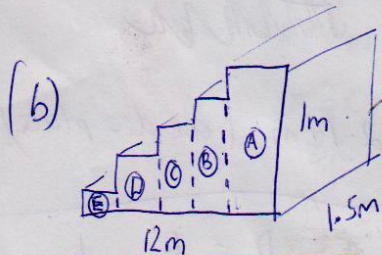


Radius = 3 angle = 120°

area of Arc = πR^2

area of sector of circle = $(\frac{120}{360})(\pi)(3)^2$

= 9.42 total area



get the volume of the 5 different blocks labelled A B C D E

Formula = L x W x H

12 ÷ 5 = 2.4m
1m ÷ 5 = 0.2m

= 1.5 x 2.4 x 1 = 3.6

= 1.5 x 2.4 x 0.6 = 2.16

3.6
2.88
2.16
1.44
0.72 +

= 1.5 x 2.4 x 0.8 = 2.88

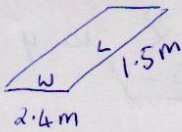
= 1.5 x 2.4 x 0.4 = 1.44

= 1.5 x 2.4 x 0.2 = 0.72

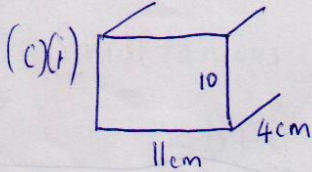
10.8 Answer

(ii) area of 3 steps = $3(L \times W)$

(9)



$$= 3(2.4 \times 1.5) + 3(0.2 \times 1.5)$$
$$= \boxed{11.7} \text{ m}^2 \text{ answer}$$



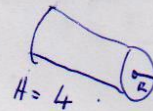
$$\text{Vol} = L \times W \times H$$
$$= 4 \times 11 \times 10$$
$$= \boxed{440 \text{ cm}^3}$$

(ii) 87.5% = block left with cylinder hole taken out
 12.5% = the amount for the cylinder hole

Total volume = 440 cm^3

12.5% of $440 = 55 \text{ cm}^3$

So cylinder hole = 55 cm^3



$$\pi R^2 H = 55$$

$$\pi (R^2)(4) = 55$$

$$R^2 = 55 \div 4\pi$$

$$R^2 = 55 \div 4\left(\frac{22}{7}\right)$$

$$R^2 = 4.375$$

$$R = \sqrt{4.375}$$

$$R = 2.09$$

$$R = 2.1 \text{ cm (one dec place)}$$

$\left(\pi = \frac{22}{7}\right)$

~~stuck~~

Q5 (a) $D = 6 \text{ km}$
 $S = 18 \text{ km/hr}$
 $T = ?$



$$T = \frac{D}{S} = \frac{6}{18} = \frac{1}{3}$$

$\frac{1}{3}$ of hour = 20 mins

leaves home $8.43 \text{ am} + 20 \text{ mins} =$

$\boxed{9.03 \text{ am}}$
arrives
answer

(b)

(a)

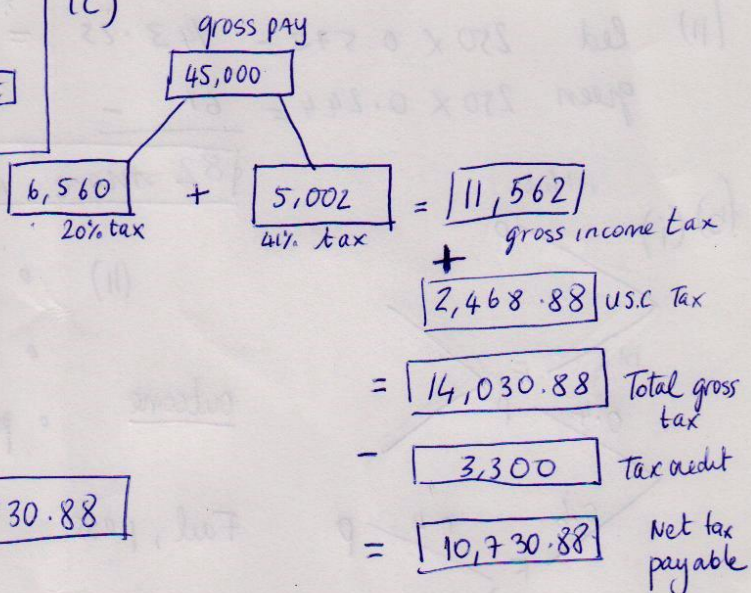
$$\begin{aligned}
 & \text{€45,000} \begin{cases} \rightarrow \text{€10,036} \times 2 \div 100 = 200.72 \\ \rightarrow \text{€5,980} \times 4 \div 100 = 239.20 \\ \rightarrow \text{€28,984} \times 7 \div 100 = 2,028.88 \end{cases} \\
 & \text{€2,468.80} \quad \boxed{\text{Total USC}}
 \end{aligned}$$

(10)

(b)

$$\begin{aligned}
 \text{Single} &= 1650 \\
 \text{PAYE} &= 1650 + \\
 & \quad \text{€3300} \quad \boxed{\text{Tax credit}}
 \end{aligned}$$

(c)



$$\begin{aligned}
 20\% \text{ tax of } 32,800 &= 6560 \\
 41\% \text{ tax of } 12,200 &= 5002 \\
 (45,000 - 32,800)
 \end{aligned}$$

Answer (c) $\boxed{10,730.88}$

(d)

$$\begin{aligned}
 \text{Net pay} &= \text{gross pay} - \text{Net tax} \\
 &= 45,000 - 10,730.88 = \boxed{\text{€34,269.12}} \quad \text{Net pay.}
 \end{aligned}$$

(c) (i)

$$\begin{aligned}
 \text{Buys tea} &= \text{€3.29} \quad \text{sells for } 60\% \text{ more} \\
 \text{€3.29} \times 60 \div 100 &= \text{€1.974} \\
 \text{€3.29} + \text{€1.974} &= \boxed{\text{€5.264}} \quad \text{Sells.}
 \end{aligned}$$

$$\begin{aligned}
 \text{€1} &= \text{€1.46} \\
 x &= \text{€5.264} \\
 1.46x &= 5.264 \\
 x &= \frac{5.264}{1.46}
 \end{aligned}$$

$$x = 3.605 = \boxed{\text{€3.61}} \quad \text{Sells in sterling}$$

(ii)

$$\begin{aligned}
 & \text{change } \text{€3.61} \text{ back to Euro with new exchange rate} \\
 \text{€1} &= \text{€1.50} \\
 \text{€3.61} &= x \\
 x &= 1.50 \times 3.61 \\
 x &= \text{€5.415} \quad \text{Sells in Euro}
 \end{aligned}$$

$$\begin{aligned}
 \text{Sells } & \text{€5.415} \\
 \text{Bought } & \text{€3.29} \rightarrow \\
 \text{profit } & \text{€2.125} \\
 \frac{2.125 \times 100}{3.29} &= 64.5\% \\
 & \boxed{65\% \text{ profit}}
 \end{aligned}$$

Q6 - (a) total of 131 lights

(11)

(i) Relative frequency = $\frac{75}{131} = 0.573$ Red, $\frac{24}{131} = 0.183$ Amber

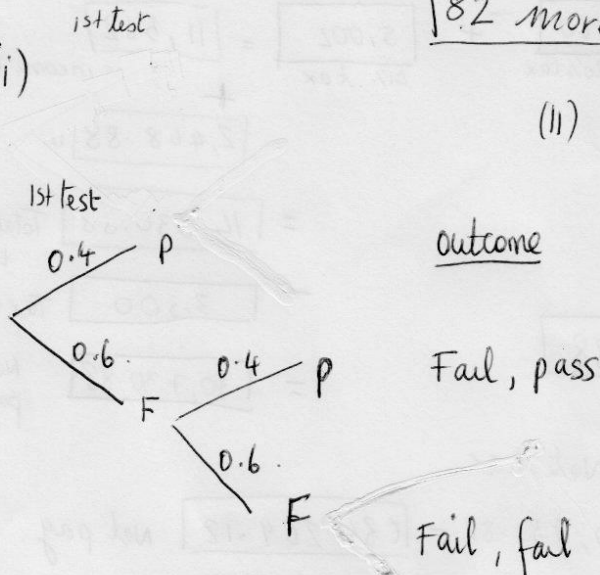
$\frac{32}{131} = 0.244$ Green

(ii) Red $250 \times 0.573 = 143.25 = \boxed{143}$ Red

green $250 \times 0.244 = 61 = \boxed{61}$

82 more red lights

(b) (i)



(ii) • passes on 1st attempt = 0.4

• fails on both $0.6 \times 0.6 = \underline{0.36}$

• passes on 2nd attempt =

$0.6 \times 0.4 = \underline{0.24}$

(c) (i) 2 red marbles, 3 Blue Marbles

Red = $\frac{2}{5}$

(ii) 10 in total now Red = $\frac{2}{10}$

(iii) 15 marbles in total

Red = $\frac{?}{15} = \frac{1}{3}$ So ? = 5, there are already 2 Red in bag so he

added 3 more