Auchmuty Model Paper A Non-Calculator Answers

1) $\frac{14}{5} \div \frac{7}{10} = \frac{14}{5} \times \frac{10}{7} = 4$

2) $3x^3 - 6x^2 + 9x + x^2 - 2x + 3 = 3x^3 - 5x^2 + 7x + 3$

3) $\underline{a} + \underline{b} = \begin{pmatrix} 2 \\ 7 \\ 1 \end{pmatrix}$

$|\underline{a} + \underline{b}| = \sqrt{2^2 + 7^2 + 1^2} = \sqrt{54} = \sqrt{9 \times 6} = 3\sqrt{6}$

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

$(3x + 2)(2x - 1) = 0 \quad \rightarrow \quad 3x + 2 = 0 \quad or \quad 2x - 1 = 0$

$x = -\frac{2}{3} \quad , \quad x = \frac{1}{2}$

5) $\frac{8}{\sqrt{10}} = \frac{8}{\sqrt{10}} \times \frac{\sqrt{10}}{\sqrt{10}} = \frac{8\sqrt{10}}{10} = \frac{4\sqrt{10}}{5}$

6) (a) $m = \frac{39-23}{18-10} = \frac{16}{8} = 2 \quad so \quad y = 2x + c$

$y = 2x + c \quad \rightarrow \quad 23 = 2 \times 10 + c \quad \rightarrow \quad c = 3$

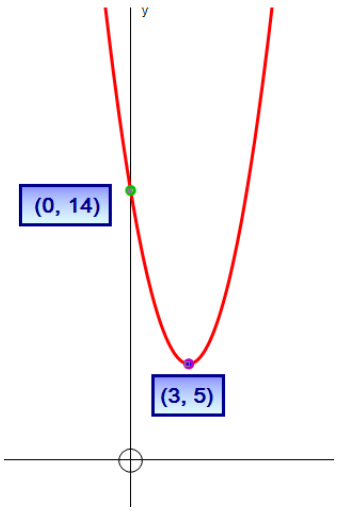
$y = 2x + 3$

(b) Film score = $2 \times 7 + 3 = 17$

7) $4a = b^2c \quad \rightarrow \quad b^2 = \frac{4a}{c} \quad so \quad b = \sqrt{\frac{4a}{c}}$

8) (a) $x^{\frac{6}{2}} + x^0 = x^3 + 1$ (b) $4^3 + 1 = 64 + 1 = 65$

9) (a) $(x - 3)^2 - 9 + 14 = (x - 3)^2 + 5$



(b)

10) (a) x – CDs ; y – DVDs : 3x + 2y = 33 (b) 4x + 3y = 47

(c) $9x + 6y = 99$
$-8x - 6y = -94$

X = 5 so 15 + 2y = 33 so 2y = 18 so y = 9

CD - £5 , DVD - £9

11) $\frac{3}{x+2} - \frac{2}{x-3} = \frac{3(x-3)-2(x+2)}{(x+2)(x-3)} = \frac{3x-9-2x-4}{(x+2)(x-3)} = \frac{x-13}{(x+2)(x-3)}$

12) (a) x = r – 4

(b) $r^2 = (r-4)^2 + 7^2$
$r^2 = r^2 - 8r + 16 + 49$
$8r = 65$ so $r = 8.125$

Auchmuty Model Paper A Calculator Answers

1) $48 \times 1.12^3 = 67.4$

2) $6.2 litres \times 1000 = 6200 ml$

$4 \times 10^4 \times 6200 = 2.48 \times 10^8$

3) (a) $\underline{b} - \underline{a}$

(b) $\underline{b} - 2\underline{a} + \underline{b} = 2\underline{b} - 2\underline{a}$

4) $y = kx^2$ $\quad (3, -27)$
$-27 = k \times 3^2$
$-27 = 9k$ $\quad so\ k = -3$

5) $a^2 = b^2 + c^2 - 2bccosA = 4^2 + 9^2 - 2 \times 4 \times 9 \times cos74 = 77.15 \ldots..$
$a = \sqrt{77.15 \ldots.} = 8.783 \ldots. = 8.8\ cm$

6) $Volume\ cone = \frac{1}{3}\pi r^2 h = \frac{1}{3} \times 3.14 \times 5^2 \times 16 = 2093.333 \ldots. cm^3$
$Volume\ hemisphere = \frac{4}{3}\pi r^3 \div 2 = \frac{4}{3} \times 3.14 \times 5^3 \div 2 = 261.666 \ldots cm^3$
$Total\ Volume = 2093.333 + 261.666 = 2354.999 = 2400\ cm^3$

7) $120\% = £288$
$1\% = £2.40$
$100\% = £240$

8) (a) Mean = 26 , standard deviation = 2.4

(b) On average, bags from Machine B has fewer sprouts.
The number of sprouts in bags from Machine B varies more.

9) $SF = \frac{20}{8} = \frac{5}{2} = 2.5$ $\quad so \quad$ $VF = 2.5^3 = 15.625$
$Large\ Volume = 0.4 \times 15.625 = 6.25\ litres$

10) (a) a = 4, b = 1

(b) $4cosx + 1 = 0$
$cosx = -\frac{1}{4}$

$cosx = \frac{1}{4}$ $\quad so \quad x = cos^{-1}(0.25) = 75.5$

$x = 180 - 75.5 = 104.5°$, $x = 180 + 75.5 = 255.5°$

11) (a) $Area = \frac{125}{360} \times 3.14 \times 30^2 = 981.25\ cm^2$

(b) $Arc = \frac{235}{360} \times 3.14 \times 60 = 122.98 \ldots = 123\ cm$

12) $No\ real\ roots \quad \rightarrow \quad b^2 - 4ac < 0$

$$(-4)^2 - 4 \times p \times 4 < 0$$

$$16 - 16p < 0$$

$$16 < 16p$$

$$p > 1$$

Auchmuty Model Paper B Non-Calculator Answers

1) $3\frac{1}{2}-\frac{3}{5}=3\frac{5}{10}-\frac{6}{10}=2\frac{15}{10}-\frac{6}{10}=2\frac{9}{10}$

2) $4x^3-10x^2+4x-6x^2+15x-6=4x^3-16x^2+19x-6$

3) $V=\frac{\sqrt{q}}{r}$ so $Vr=\sqrt{q}$ so $q=(Vr)^2$

4) (a) $2\underline{u}+2\underline{v}$

(b) $-\underline{u}+2\underline{v}$

5) $<QRS=42°$

6) $\frac{2y^2+6y}{y^2+2y-3}=\frac{2y(y+3)}{(y+3)(y-1)}=\frac{2y}{y-1}$

7) $\left(\sqrt[3]{8}\right)^2=2^2=4$

8) $\frac{2}{m}+\frac{3}{m-1}=\frac{2(m-1)+3m}{m(m-1)}=\frac{2m-2+3m}{m(m-1)}=\frac{5m-2}{m(m-1)}$

9) (a) $Roots\ when$ $8+2x-x^2=0$

$x^2-2x-8=0$

$(x-4)(x+2)=0$

$x=4\ ;\ x=-2$ $so\ A(-2\,,0)$ $B(4\,,0)$

(b) x = 1

(c) $x=1$ so $y=8+2\times1-1^2=9$

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

$2y+x=10$ $6y+3x=10$

Add : 7y = 28 so y = 4

$If\ y=4:$ $2\times4+x=10$ so $x=10-8=2$ so $P(2\,,4)$

11) a = 6 , b = 6

12) $cosB=\frac{4^2+2^2-3^2}{2\times4\times2}=\frac{16+4-9}{16}=\frac{11}{16}$

13) $A=l\times b=4\sqrt{3}\times2\sqrt{6}=8\sqrt{18}=8\sqrt{9\times2}=8\times3\sqrt{2}=24\sqrt{2}$

14) $b^2-4ac=3^2-4\times2\times(-2)=9+16=25>0$ so 2 real and distinct roots

Auchmuty Model Paper B Calculator Answers

1) $450 \times 1.063 = 574.5734 \ldots = £574.57$

2) Mean = 9 , standard deviation = 4.1

(b) After a New coach :- on average, the number of goals scored increased; the number of goals scored varied less.

3) M(0 , 3 , 0) N(8 , 6 , 3)

4) $m = \frac{5-(-3)}{2-(-2)} = \frac{8}{4} = 2 \quad so \quad y = 2x + c$

$y = 2x + c \quad \rightarrow \quad 5 = 2 \times 2 + c \quad \rightarrow \quad c = 1$

$so \quad y = 2x + 1$

5) $Arc = \frac{46}{360} \times 3.14 \times 2.8 = 1.12\ m$ Yes, Arc = 1.12 m > 0.8m

6) $Large\ cone: V = \frac{1}{3}\pi r^3 h = \frac{1}{3} \times 3.14 \times 12.5^2 \times 18 = 2093.333 \ldots . cm^3$
$Small\ cone: V = \frac{1}{3}\pi r^3 h = \frac{1}{3} \times 3.14 \times 6^2 \times 4 = 150.72\ cm^3$
$Volume\ water = 2093.333 - 150.72 = 2793.03 = 2800\ cm^3$

7) $105\% = £892.50$
$1\% = £8.50$
$100\% = £850$

8) CB = 18.1 m

9) $SF = \frac{2.4}{0.6} = 4 \quad so \quad AF = 4^2 = 16$
$Large\ Area = 0.9 \times 16 = 14.4\ cm^2$

10) $Area\ Triangle = \frac{1}{2} \times 50 \times 50 \times sin112° = 1158.97 \ldots = 1159\ cm^2$
$Area\ Rhombus = 1159 \times 2 = 2318\ cm^2$

11) (a) $f(270) = 4 \times \sin 270° = -4$

(b) $f(t) = 0.8 \quad \rightarrow \quad 4sint = 0.8 \quad \rightarrow \quad sint = 0.2$

$t = \sin(0.2) = 11.5$
$t = 11.5°, \quad 180 - 11.5 = 168.5°$

12) $x^2 = 1.4^2 - 1^2 = 0.96$

$x = \sqrt{0.96} = 0.98$

$Depth = 1.4 - 0.98 = 0.42\ m$

13) (a) $2 \times 4x = x^2 + 7 \Rightarrow 8x = x^2 + 7 \Rightarrow x^2 - 8x + 7 = 0$

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

x = 1 and x = 7 but if QR = 5cm is smallest side then x = 7.

Auchmuty Model Paper C Non-Calculator Answers

1) $\frac{3}{4} \div \frac{17}{8} = \frac{3}{4} \times \frac{8}{17} = \frac{24}{68} = \frac{6}{17}$

2) $3(a^2 - 4) = 3(a + 2)(a - 2)$

3) $f(-2) = 7 - (-2)^2 = 7 - 4 = 3$

4) $3(2x + 3) = x - 2 \quad so \quad 6x + 9 = x - 2 \quad so \quad 5x = -11$

$x = -\frac{11}{5}$

5) $\sqrt{4 \times 2} + \sqrt{9 \times 2} - \sqrt{2} = 2\sqrt{2} + 3\sqrt{2} - \sqrt{2} = 4\sqrt{2}$

6) $(x + 4)^2 - 16 + 7 = (x + 4)^2 - 9$

7) (a) $24x + 6y = 60$

(b) $20x + 10y = 40$

(c) $24x + 6y = 60 \quad (\times 5) \quad \rightarrow \quad 120x + 30y = 300$
$20x + 10y = 40 \quad (\times -3) \quad \rightarrow \quad -60x - 30y = -120$
$Add \quad 60x = 180$
$x = 3$

$sub\ x = 3\ in\ 1{:}\ 24 \times 3 + 6y = 60 \quad \rightarrow \quad 72 + 6y = 60 \quad \rightarrow \quad 6y = -12 \quad \rightarrow \quad y = -2$

$17 \times 3 - 13 \times 2 = 25$

8) $142°$

9) $m = \frac{50-10}{81-21} = \frac{40}{60} = \frac{2}{3} \quad so \quad y = \frac{2}{3}x + c$
$y = \frac{2}{3}x + c \quad \rightarrow \quad 10 = \frac{2}{3} \times 21 + c \quad \rightarrow \quad c = -4$

$y = \frac{2}{3}x - 4 \quad \rightarrow \quad g = \frac{2}{3}h - 4$

10) $\frac{3}{4}\underline{a} + \frac{1}{2}\underline{b}$

11) $\frac{a^{\frac{4}{2}}}{a} = \frac{a^2}{a} = a$

12) $\frac{8}{sin150} = \frac{4}{sinB} \Rightarrow 8sinB = 4sin150 \Rightarrow 8sinB = 2 \Rightarrow sinB = \frac{1}{4}$; use $sin150 = sin30 = \frac{1}{2}$

13) $\frac{sin^2A}{1-sin^2A} = \frac{sin^2A}{cos^2A} = tan^2A$

Auchmuty Model Paper C Calculator Answers

1) $P = 2 \times 2.4 \times 10^{-7} \times 3.2 \times 10^{5} = 0.1536 = 1.536 \times 10^{-1}$

2) $x(x^2 - 4x + 4) = x^3 - 4x^2 + 4x$

3) $Arc = \frac{73}{360} \times 3.14 \times 8.4 = 5.348 \ldots \ldots = 5.3\ metres$

4) $m = a + 3b^2 \quad \rightarrow \quad m - a = 3b^2 \quad \rightarrow \quad \frac{m-a}{3} = b^2$

$b = \sqrt{\frac{m-a}{3}}$

5) $a = 2\,, b = 5\,, c = -9$

$b^2 - 4ac = 5^2 - 4 \times 2 \times (-9) = 25 + 72 = 97$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-5 \pm \sqrt{97}}{4}$

$x = \frac{-5 + \sqrt{97}}{4} \quad or \quad x = \frac{-5 + \sqrt{97}}{4}$

$x = 2.21 \ldots \ldots = 1.2 \quad or \quad x = -3.712 \ldots . = -3.7$

6) (a) median = 32.5 interquartile range = 37 - 30 = 7

(b) December – median is higher so the test scores are better on average
Interquartile range is the lower so the test scores vary less

7) $SF = \frac{110}{70} = 1.5714 \ldots \qquad AF = (1.5714 \ldots)^2 = 2.469.. = 2.47$

Claim is unjustified as Area factor is 2.47 which is less than 3.

13) $a^2 = b^2 + c^2 - 2bccosA = 70^2 + 65^2 - 2 \times 70 \times 65 \times cos108 = 11937.05 \ldots ..$

$a = \sqrt{11937.05 \ldots .} = 109.25 \ldots . = 109\ km$

8) $3\underline{a} = \begin{pmatrix} 9 \\ 0 \\ 6 \end{pmatrix} \quad so \quad 3\underline{a} - \underline{b} = \begin{pmatrix} 9 - (-2) \\ 0 - 1 \\ 6 - 3 \end{pmatrix} = \begin{pmatrix} 11 \\ -1 \\ 3 \end{pmatrix}$

$\left|3\underline{a} - \underline{b}\right| = \sqrt{11^2 + (-1)^2 + 3^2} = \sqrt{131}$

9) $Longest\ side: 150^2 = 22500$
$Shortest\ side: 120^2 = 14400$
$Middle\ side: 90^2 = 8100$

$81000 + 144000 = 22500 = longest\ side\ squared.$

By converse of Pythagoras, triangle is right-angled.

10) $Area\ base = \frac{1}{2}absinC = \frac{1}{2} \times 5 \times 5 \times sin60 = 10.8\ cm^2$

$V = \frac{1}{3}Ah = 28.86 \ldots . = 28.9cm^3$

11) (a) $a = -4 \quad , \quad b = 2$

(b) $At\ P, x = 0 : y = (x-4)^2 + 2 = (-4)^2 + 2 = 18 \quad so \quad P(0\ ,18)$

$Using\ symmetry,\ Q\ is\ (8\ ,18)$

12) (a) $5sinx\ has \max of\ 5\ at\ 90°,\ so\ 5sinx - 2\ has \max of\ 3\ at\ 90°. So\ P(90°\ ,3)$

(b)$At\ Q\ and\ R, y = 0$

$5sinx - 2 = 0 \quad \rightarrow \quad 5sinx = 2 \quad \rightarrow \quad sinx = \frac{2}{5} = 0.4$

$x = \sin(0.4) = 23.6°$

$x = 23.6°, \quad 180 - 23.6 = 156.4°$

13) $Flare\ enters\ sea\ when\ h = 0 : \quad 0 = 24 + 5t - t^2$

$t^2 - 5t - 24 = 0 \quad \rightarrow \quad (t-8)(t+3) = 0$

$t - 8 = 0 \quad , \quad t + 3 = 0$

$t = 8 \quad , \quad t = -3$

$Time\ cannot\ be\ negative\ so\ t = 8\ seconds$

D-Non-Calc

① $1\frac{3}{4} + \frac{1}{2} \times 1\frac{4}{5}$

$\frac{7}{4} + \left(\frac{1}{2} \times \frac{9}{5}\right)$ BODMAS!

$\frac{7}{4} \times \frac{9}{10}$

$\frac{70+36}{40}$

$\frac{106}{40}$

$2\frac{26}{40}$

$2\frac{13}{20}$

② $2 - x > 3(x-2)$

$2 - x > 3x - 6$

$2 + 6 > 3x + x$

$8 > 4x$

$4x < 8$

$x < \frac{8}{4}$

$x < 2$

③ $2p^2 + 9p - 5$ (multiply)

-10, $10, -1$

$2p^2 + 10p - 1p - 5$

$2p(p+5) - 1(p+5)$

$(2p-1)(p+5)$

④ $D = 4$ so $r = 2$

$V = \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times 3.14 \times 3^3$

$= \frac{4}{3} \times 3.14 \times 27$

$= [redacted]$

$= 4 \times 3.14 \times 9$

$= 12.56 \times 9$

$= 113.04\ cm^3$

⑤ $3x - 4y = 20$ — ①

$4x + 5y = 6$ — ②

① $\times 5 \Rightarrow$ $15x - 20y = 100$ — ③

② $\times 4 \Rightarrow$ $16x + 20y = 24$ — ④

③ + ④ $\Rightarrow$ $31x = 124$

$x = \frac{124}{31}$

$x = 4$

Sub $x = 4$ into ② $\Rightarrow$ $16 + 5y = 6$

$5y = -10$

$y = \frac{-10}{5}$

$y = -2$

(6) S.F. $= \frac{16}{12} = \frac{4}{3}$

V.S.F. $= \left(\frac{4}{3}\right)^3 = \frac{64}{27}$

Volume $= \frac{64}{27} \times 54$

$= 54 \div 27 \times 64$

$= 128\text{mL}$

(7)(a) $\bar{x} = \frac{15}{5} = 3$

x	$x-\bar{x}$	$(x-\bar{x})^2$
1	−2	4
2	−1	1
2	−1	1
4	1	1
6	3	9
		16

S.D. $= \sqrt{\frac{16}{4}}$

$= \sqrt{4}$

$= 2$

(b) 2

(8) Using (0, 65) and (20, 23)

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{23-65}{20-0}$

$= \frac{-42}{20}$

$= -2.1$ so $y = -2.1x + 65$

$S = -2.1T + 65$

(b) if $T = 30$, $S = -2.1 \times 30 + 65 = -63 + 65 = 2$ → ie $\neq 2$

(9) 15% extra so

115% = 460g

1% $= \frac{460}{115} = 4$g

100% = 400g

(10) Starts Late by 30 places

so $a = 30$

$y = \sin(x - 30)^\circ$

(11) $\frac{15\sqrt{3}}{\sqrt{3} \times \sqrt{3}}$

$\frac{5}{\cancel{15}\sqrt{3}}{\cancel{3}_1}$

$5\sqrt{3}$

(12)(a) $S = \frac{D}{T}$ so $\frac{50}{x}$

(b) $\frac{50}{x+2}$

(c) $\frac{50}{x+2}$ $\frac{50}{x}$

$$\frac{50x - 50(x+2)}{x(x+2)}$$

$$\frac{50x - 50x - 100}{x(x+2)}$$

$$\frac{-100}{x(x+2)}$$

$$-\frac{100}{x(x+2)}$$

i.e. Difference is

$$\frac{100}{x(x+2)}$$

(13)(a) $y = (x+3)^2 - 14$

P $(-3, -14)$

(b) $P \to Q$

$-3 \to 1$

so 4 along x-axis

so Q is $(5, -14)$

(c) S is $(13, -14)$

so equation is $y = (x-13)^2 - 14$

~~$y = x - 13$~~

D - Calc

① 1492(7)19214375
↑ bigger than 5

£ 1493000000000

② $\underline{s} = \begin{pmatrix} 5 \\ -1 \end{pmatrix}$ $\underline{t} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$

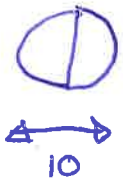
$\underline{s} + \underline{t} = \begin{pmatrix} 5 \\ -1 \end{pmatrix} + \begin{pmatrix} -2 \\ 3 \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$

③ $y = -x^2$

sub in $(-4, k)$ ⇒ $k = -(-4)^2$
x y

$k = -16$

④ 2 end parts make a sphere!

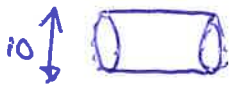


$V = \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times 3.14 \times 5^3$

$= 523.333... mm^3$

Middle part is a cylinder!



$V = \pi r^2 h$

$= 3.14 \times 5^2 \times 12$

$= 942 mm^3$

Total = 942 + 523.333...

$= 1465.33... mm^3$

⑤ $G(0, 4, 4)$

$Q(2, 4, 2)$

⑥ $x^4 \times (x^2)^{-3}$

$x^4 \times x^{-6}$

$x^{4+(-6)}$

x^{-2}

(or $\frac{1}{x^2}$)

⑦(a) $3y + x = 12$

$3y = -x + 12$

$y = -\frac{1}{3}x + 4$

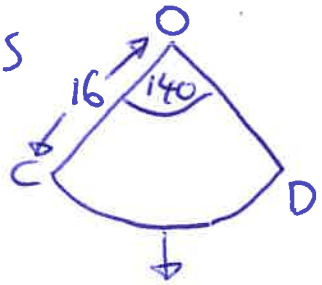
↓

$m = -\frac{1}{3}$

(b) if $x = 0$, $y = -\frac{1}{3}(0) + 4 = 4$

$(0, 4)$

(8) Shaded area is



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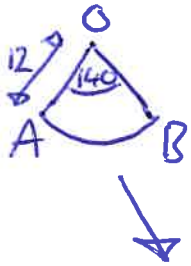

$A = \frac{140}{360}$ of 3.14×16^2

$= 312.604....$

$A = \frac{140}{360}$ of 3.14×12^2

$= 175.84$

Shaded area = OCD − OAB

$= 136.764...$ inches^2

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(9) $2x - 3x^2 = 5$

$-3x^2 + 2x - 5 = 0$

$a = -3$
$b = 2$
$c = -5$

$b^2 - 4ac$

$2^2 - 4 \times (-3) \times (-5)$

$4 - 60$

-54

$b^2 - 4ac < 0$

so no real roots

(10) Not right-angled.

Mentions area (!)

so $A = \frac{1}{2} ab \sin C$

$21 = \frac{1}{2} \times 8 \times 6 \times \sin P$

$21 = 24 \sin P$

$\frac{21}{24} = \sin P$

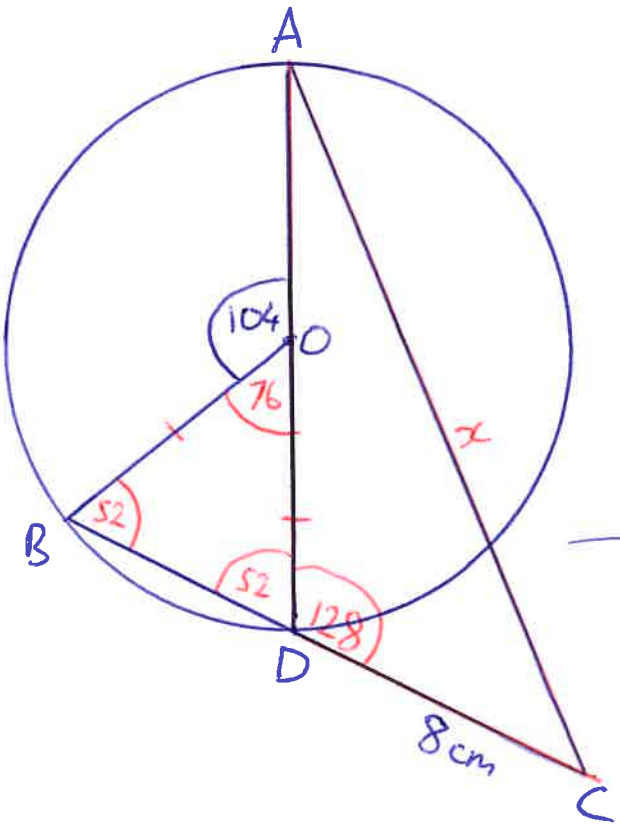
$P = \sin^{-1}\left(\frac{21}{24}\right)$

$P = 61.0°$ to 1 d.p.

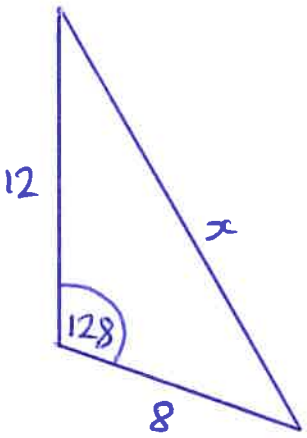
However, angle P is obtuse!

so $P = 180 - 61 = 119°$

(11)



radius = 6 so AD = 12cm



cosine rule!

$x^2 = 12^2 + 8^2 - 2 \times 12 \times 8 \times \cos 128$

$x^2 = 326.207...$

$x = 18.061...$ cm

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(12) Pythagoras!

$x^2 + (x+1)^2 = (x+2)^2$

$x^2 + x^2 + 2x + 1 = x^2 + 4x + 4$

$2x^2 - x^2 + 2x - 4x + 1 - 4 = 0$

$x^2 - 2x - 3 = 0$ (-3)

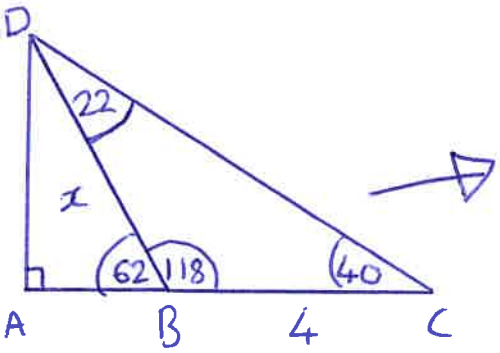
$(x-3)(x+1) = 0$ -3, 1

$x - 3 = 0$, $x + 1 = 0$

$x = 3$, $x = -1$

not valid length

(13)



Sine Rule

$$\frac{x}{\sin 40} = \frac{4}{\sin 22}$$

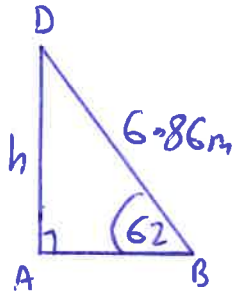
$$x \sin 22 = 4 \sin 40$$

$$x = \frac{4 \sin 40}{\sin 22}$$

$$x = 6.863\ldots$$

$$x \simeq 6.86\text{m}$$

Now



so using sine rule again

$$\frac{h}{\sin 62} = \frac{6.86}{\sin 90}$$

$$h \sin 90 = 6.86 \sin 62$$

$$h = \frac{6.86 \sin 62}{\sin 90}$$

$$h = 6.057\ldots$$

$$h = 6.06\text{m}$$

or using SohCahToa

$$\sin 62 = \frac{h}{6.86}$$

$$h = 6.86 \sin 62$$

$$h = 6.06\text{m}$$

---

(14) 86% of cars being used every 10 years

so $0.86^5 = 0.47\ldots$

i.e 47% of cars still on the road,

so car usage has reduced by 53%.

Yes, government have succeeded as $53\% > 40\%$

15 (a) if $h=6$, $D = 4 + 1.5\sin 180 = 4\text{m}$

(b) The depth is given by the graph of

$$D = 1.5\sin 30h^\circ + 4$$

This is a sine graph with an amplitude of 1.5

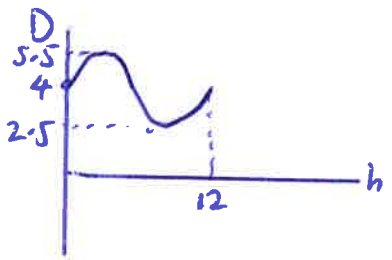
ie. max value of 1.5 and min value of −1.5

This shifts the graph vertically up 4

So max height is $1.5 + 4 = 5.5\text{m}$

& min height is $-1.5 + 4 = 2.5\text{m}$

Note if we graphed the Depth we would get!



E- Non-Calc

① $1\frac{5}{6} \div \frac{5}{12}$

$\frac{11}{6} \div \frac{5}{12}$

$\frac{11}{\cancel{6}_{1}} \times \frac{\cancel{12}^{2}}{5}$

$\frac{22}{5}$

$4\frac{2}{5}$

② $(2x+5)(x^2-x+4)$

$2x^3-2x^2+8x+5x^2-5x+20$

$2x^3+3x^2+3x+20$

③ $\underline{a}+\underline{b} = \begin{pmatrix}-2\\0\\3\end{pmatrix} + \begin{pmatrix}3\\-4\\1\end{pmatrix}$

$= \begin{pmatrix}1\\-4\\4\end{pmatrix}$

$|\underline{a}+\underline{b}| = \sqrt{1^2+(-4)^2+4^2}$

$= \sqrt{1+16+16}$

$= \sqrt{33}$

④ $6x^2+13x-5$ (multiply)

-30

$15, -2$

$6x^2+15x-2x-5$

$3x(2x+5)-1(2x+5)$

$(3x-1)(2x+5)=0$

$3x-1=0$ or $2x+5=0$

$3x=1$ or $2x=-5$

$x=\frac{1}{3}$ or $x=\frac{-5}{2}$

$x=-\frac{5}{2}$

(5) $\frac{2 \times \sqrt{6}}{\sqrt{6} \times \sqrt{6}}$

$\frac{2\sqrt{6}}{6}$

$\frac{\sqrt{6}}{3}$

(6) (a) (7, 22) and (11, 34)

$m = \frac{34-22}{11-7}$

$= \frac{12}{4}$

$= 3$

$y - 22 = 3(x-7)$

$y - 22 = 3x - 21$

$y = 3x + 1$

(b) sub. in $x = 6$

$y = 3(6) + 1$

$= 18 + 1$

$= 19$

Sport score is 19

(7) $\frac{4\sqrt{q}}{r} = p$

$4\sqrt{q} = pr$

$\sqrt{q} = \frac{pr}{4}$

$q = \left(\frac{pr}{4}\right)^2$

(or $q = \frac{p^2 r^2}{16}$)

(8) (a) $x^{\frac{3}{2}}\left(x^{\frac{1}{2}} + x^{-\frac{1}{2}}\right)$

$x^{\frac{4}{2}} + x^{\frac{2}{2}}$

$x^2 + x$

(b) if $x = 6$,

$6^2 + 6$

$36 + 6$

42

(9) (a) $y = x^2 + 4x + 2$

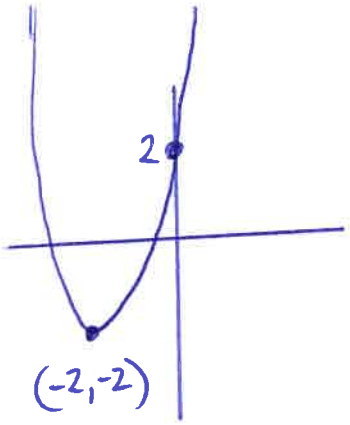
$y = (x+2)^2 - 4 + 2$

$y = (x+2)^2 - 2$

(b) TP at $(-2, -2)$

y-intercept when $x = 0$

so $y = 0^2 + 4(0) + 2 = 2$ $(0, 2)$



(10) (a) $2c + 3d = 40$ — (1)

(b) $5c + 2d = 56$ — (2)

(c) (1) $\times 2 \Rightarrow 4c + 6d = 80$ — (3)

(2) $\times (-3) \Rightarrow -15c - 6d = -168$ — (4)

(3) + (4) $\Rightarrow -11c = -88$

$c = \frac{-88}{-11}$

$c = 8$

sub $c = 8$ into (1) $\Rightarrow 16 + 3d = 40$

$3d = 24$

$d = \frac{24}{3}$

$d = 8$

CD costs £8

DVD costs £8

(11) $\frac{5}{x+1} - \frac{3}{x-2}$

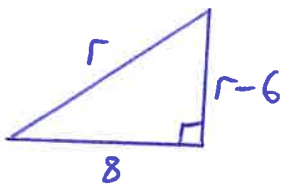
$\frac{5(x-2) - 3(x+1)}{(x+1)(x-2)}$

$\frac{5x - 10 - 3x - 3}{(x+1)(x-2)}$

$\frac{2x - 13}{(x+1)(x-2)}$

(12) (a) x is radius minus 6

so $x = r - 6$



(b) $r^2 = 8^2 + (r-6)^2$

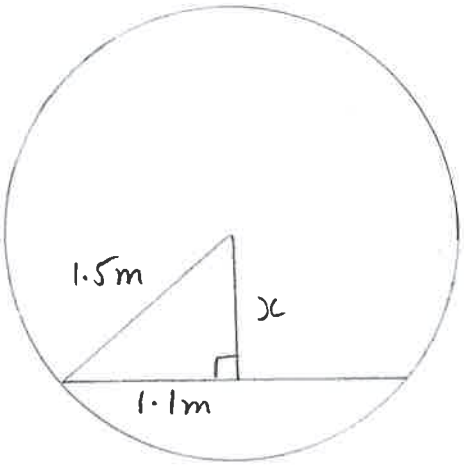
$r^2 = 64 + r^2 - 12r + 36$

$r^2 - r^2 + 12r = 100$

$12r = 100$

$r = \frac{100}{12} = \frac{50}{6} = \frac{25}{3}$ cm (or $8\frac{1}{3}$ cm)

12.



$x^2 = 1.5^2 - 1.1^2$

$x^2 = 1.04$

$x = \sqrt{1.04}$

$x = 1.0m$

Depth $= 1.5 - 1.0$

$= \underline{0.5m}$

13a. Scale factor $= 3$

$3(3x) = x^2 + 8$

$9x = x^2 + 8$

$0 = x^2 - 9x + 8$

Hence shown.

b. $x^2 - 9x + 8 = 0$

$(x - 1)(x - 8) = 0$

$x - 1 = 0 \qquad x - 8 = 0$

$x = 1 \qquad x = 8$

$x = 1$ is not a solution in this context as $3 \times 1 = 3$cm but we are told QR $= 4$cm is the shortest side.

So $x = 8$

Paper F (Non calc.)

1. $\frac{17}{4} - \frac{8}{5}$

$= \frac{85}{20} - \frac{32}{20}$

$= \frac{53}{20}$

$= 2\frac{13}{20}$

---

2. $(2x-3)(2x^2-5x+2)$

$= 4x^3 - 10x^2 + 4x - 6x^2 + 15x - 6$

$= 4x^3 - 16x^2 + 19x - 6$

---

3. $a = \frac{5}{cd^2}$

$acd^2 = 5$

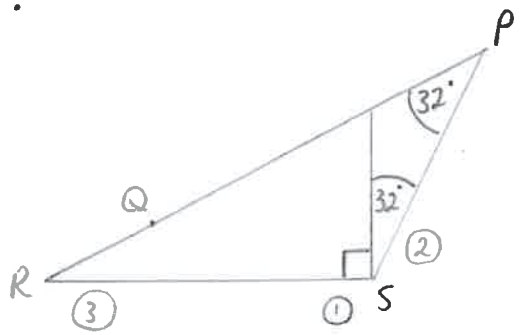
$d^2 = \frac{5}{ac}$

$d = \sqrt{\frac{5}{ac}}$

4a. $\overrightarrow{AD} = \underline{u} + \underline{v}$

b. $\overrightarrow{EC} = -2\underline{v} + 2\underline{u}$

5.



5. (ctd.)

① 90° as a tangent

② 32° as ΔPOS is isoceles

③ $180 - (32 + 122)$

$= 26°$

---

6. $\frac{6x^2 - 3x}{2x^2 + 9x - 5}$

$= \frac{3x(2x-1)}{(2x-1)(x+5)}$

$= \frac{3x}{(x+5)}$

---

7. $9^{\frac{3}{2}}$

$= (\sqrt{9})^3$

$= 3^3$

$= 27$

---

8. $\frac{5(a-2) + 2(a+1)}{(a+1)(a-2)}$

$= \frac{5a - 10 + 2a + 2}{(a+1)(a-2)}$

$= \frac{7a - 8}{(a+1)(a-2)}$

9a. To find roots $y = 0$

$0 = 3 + 2x - x^2$

$x^2 - 2x - 3 = 0$

$(x + 1)(x - 3) = 0$

$x + 1 = 0$ OR $x - 3 = 0$

$x = -1$ $\quad x = 3$

$A(-1, 0)$ $\quad B(3, 0)$

b. Midpoint $\frac{-1 + 3}{2} = 1$

$x = 1$

c. when $x = 1$ (sub in $x = 1$)

$y = 3 + 2(1) - (1)^2$

$= 3 + 2 - 1$

$= 4$

10.

$y = 2x + 3$ ①

$3y = -x + 16$ ②

$+ \quad 6y = -2x + 32$ ③ = ② × 2

$7y = 35$ ④ = ① + ③

$y = 5$

sub $y = 5$ into ①

$5 = 2x + 3$

$2 = 2x$

$x = 1$

$P(1, 5)$

11.

$a = 3$

$b = 2$

12. $\cos B = \frac{a^2 + c^2 - b^2}{2ac}$

$= \frac{6^2 + 8^2 - 4^2}{2 \times 6 \times 8}$

$= \frac{36 + 64 - 16}{2 \times 6 \times 8}$

$= \frac{84}{96} \overset{\div 12}{=} \frac{7}{8}$

13. $A = lb$

$= 3\sqrt{5} \times \sqrt{10}$

$= 3\sqrt{50}$

$= 3\sqrt{25}\sqrt{2}$

$= 3 \times 5 \times \sqrt{2}$

$= 15\sqrt{2}$ cm^2

14. $3x^2 + 8x + 2 = 0$

$a = 3$
$b = 8$
$c = 2$.

Use discriminant $b^2 - 4ac$

$= 8^2 - (4 \times 3 \times 2)$

$= 64 - 24$

$= 40$

As $b^2 - 4ac \geq 0$ then roots are real.

Paper F (Calculator)

1. $700\left(1+\frac{4.1}{100}\right)^3$

$= 700 \times (1.041)^3$

$= 789.678...$

$= £789.68$

2a. $\bar{x} = \frac{70}{5} = 14$

Standard deviation

x	$x-\bar{x}$	$(x-\bar{x})^2$
15	1	1
12	-2	4
13	-1	1
17	3	9
13	-1	1
		$\Sigma = 16$

$s.d. = \sqrt{\frac{16}{5-1}}$

$= \sqrt{4}$

$= 2$

b. Under the new coach on average the player scored less goals (so performed less well)

Also under the new coach the player was less consistent.

3. $M(0,2,0)$

$N(7,4,4)$

4. $m = \frac{y_2-y_1}{x_2-x_1} = \frac{10-(-2)}{6-(-3)}$ ($x_1\ y_1$ $(-3,-2)$; $x_2\ y_2$ $(6,10)$)

$= \frac{12}{9}$

$= \frac{4}{3}$

Method (1)

$y = mx + c$

$y = \frac{4}{3}x + c$

sub in $(6,10)$

$10 = \frac{4}{3} \times 6 + c$

$10 = 8 + c$

$c = 2$

so

$y = \frac{4}{3}x + 2.$

OR Method (2)

sub in $(6,10)$

$y - 6 = m(x-a)$

$y - 10 = \frac{4}{3}(x-6)$

$y - 10 = \frac{4}{3}x - 8$

$y = \frac{4}{3}x + 2$

5. Arc length $= \frac{\text{angle}}{360} \times \pi d$

$= \frac{38}{360} \times 3.14 \times 3.6$

$= 1.19m$

$1.19_m > 1.1m$ therefore the staircase will pass safety regulations

6. Volume = $Vol_{LARGE} - Vol_{SMALL}$

$Vol_{LARGE} = \frac{1}{3}\pi r^2 h$

$= 3.14 \times 16^2 \times 26 \div 3$

$= 6966.6\ cm^3$

$Vol_{SMALL} = \frac{1}{3}\pi r^2 h$

$= 3.14 \times 4^2 \times 4 \div 3$

$= 67.0\ cm^3$

$Vol = 6966.6 - 67.0$

$= 6899.6\ cm^3$

$= \underline{6900\ cm^3 (\text{to 2 sig. fig.})}$

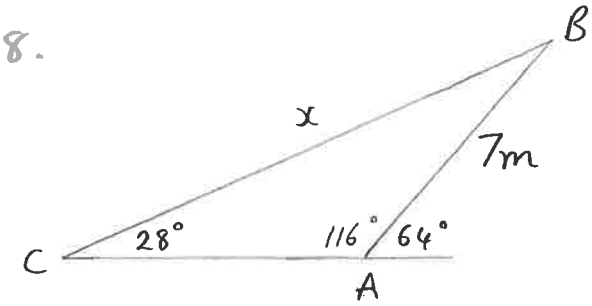
7. $100\% = 979.44$

$1\% = 979.44 \div 100$

$94\% = 979.44 \div 100 \times 94$

$= \underline{£920.67}$

8.



Angle CAB = 180 − 64

= 116°

$\frac{a}{\sin A} = \frac{c}{\sin C}$

$\frac{x}{\sin 116^\circ} = \frac{7}{\sin 28^\circ}$

$x = \frac{7 \times \sin 116}{\sin 28}$

$= \underline{13.4\ m}$

9. Scale factor $= \frac{3.5}{0.7} = 5$

Area scale factor $= 5^2$

Area $= 0.8 \times 5^2 = \underline{20\ cm^2}$

10.

Area of triangle $= \frac{1}{2}ab\sin C$

$= 50 \times 50 \times \sin 112$

$= 2318.0\ cm^2$

Therefore Area of rhombus $= 2 \times 2318.0$

$= \underline{4636\ cm^2}$

11. a $f(180) = 3 \times \cos 180$

$= -3$

b. $f(t) = 3\cos t$

$3\cos t = 1.2$

$\cos t = \frac{1.2}{3}$

$\cos t = 0.4$

180 − x	✓ x
S	A
T	C ✓
180 + x	360 − x

1st Quadrant $t = \cos^{-1} 0.4$

$= \underline{66.4^\circ}$

4TH Quadrant $t = 360 - 66.4 = \underline{293.6^\circ}$