E.M. Paper 1 2012 V1.0

1 (a) $\frac{11.83^2}{18.52 - 2.79} = 8.8969$ #

(b) $8.8969 \approx 8.9$ (2 s.f.) #

2 (a) Exterior $\angle = 180° - 140°$
$= 40°$

Exterior $\angle = \frac{360°}{n}$

$n = \frac{360°}{40°}$

$= 9$ #

(b) Exterior $\angle$ of a regular decagon $= \frac{360°}{10}$
$= 36°$ #

3 (a) Probability $= \frac{10}{10+5+3}$
$= \frac{10}{18}$
$= \frac{5}{9}$ #

(b) let x be the no. of blue marbles

$\frac{5+x}{18+x} = \frac{1}{2}$

$18 + x = 2(5+x)$

$18 + x = 10 + 2x$

$x = 8$ #

4 (a) Range = 67 − 32

= 35 *

(b) Median = mean of 8th and 9th value

$= \frac{42+45}{2}$

= 43.5 *

5. $y = ka^x$

Sub (0, 5), $5 = ka^0$

$k = 5$ *

Sub (6, 320) and $k = 5$,

$320 = 5a^6$

$a^6 = \frac{320}{5}$

$a^6 = 64$

$a^6 = 2^6$

$a = 2$ * or -2 (rejected).

6. 1.5 litres $= 1500\ cm^3$

$\pi r^2 h = 1500$

$\pi (6.8)^2 h = 1500$

$h = \dfrac{1500}{\pi \times 6.8^2}$

$= 10.32$

$\therefore 10.3$ cm (3 s.f.) #

7. (a) $5, 9, 13, 17, 21, 25, 29, \underline{33}$ #

(b) a_n = term before 1st term + n x common difference

$= 1 + n \times 4$

$= 1 + 4n$ #

(c) $1 + 4n = 205$

$4n = 204$

$n = 51$

8. $\dfrac{2x-3}{6} + \dfrac{x+2}{3} = \dfrac{5}{2}$

$\dfrac{2x-3+2(x+2)}{6} = \dfrac{5}{2}$

$\dfrac{2x-3+2x+4}{6} = \dfrac{5}{2}$

$2(4x+1) = 30$

$8x + 2 = 30$

$8x = 28$

$x = 3.5$ #

9(a) $1008 = 2^4 \times 3^2 \times 7$

$\Rightarrow x = 4, y = 2$ #

(b) $\frac{1350}{k} = \frac{2 \times 3^3 \times 5^2}{k}$ => square number

$\Rightarrow k = 2 \times 3$

$= 6$ #

10. (a) 4 cm : 1 km

4 cm : 100000 cm

1 cm : 25000 cm

1 : 25000 #

(b) 1 cm : $\frac{1}{4}$ km

$1 cm^2 : \frac{1}{16} km^2$

$236 cm^2 : 236 \times \frac{1}{16}$

$= 14.75 km^2$ #

11. (a) $2(3x+2y)-5(x-2y)$

$= 6x+4y-5x+10y$

$= x+14y$ #

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

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

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

$= \frac{3-x}{(x+2)^2}$ #

12. (a) mean height

$= \frac{4(145)+9(155)+11(165)+6(175)}{30}$

$= 161.33$

≈ 161 (3 s.f.) #

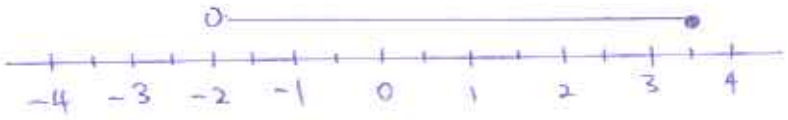
(b) Standard deviation

$= \sqrt{\frac{4(145)^2+9(155)^2+11(165)^2+6(175)^2}{30} - (161.33)^2}$

$= 9.4809$

≈ 9.48 (3 s.f.)

13(a)



(b) $-9 \leq 4x - 3 < 9$

$-9 \leq 4x - 3$

$-9 + 3 \leq 4x$

$4x \geq -6$

$x \geq -\frac{3}{2}$

$4x - 3 < 9$

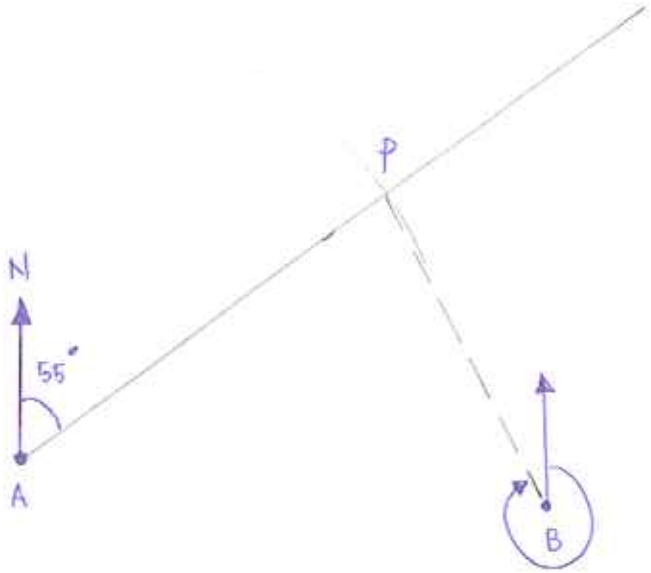
$4x < 12$

$x < 3$

$\therefore \quad -\frac{3}{2} \leq x < 3$ #

14. Scale: 1cm : 10 km

(a)



(b) BP = 4.7 cm

= 47 km #

(c) Bearing of the aeroplane from B = 330° #

15 (a) $A\hat{O}B = 180° - 2(35°)$ ($\triangle AOB$ is an isos. $\triangle$)

$= 110°$ #

(b) $A\hat{C}B = \frac{110°}{2}$ ($\angle$ at centre $= 2\angle$ at O^{ce})

$= 55°$ #

(c) $A\hat{T}B = 360° - A\hat{O}B - T\hat{A}O - T\hat{B}O$ (sum of interior $\angle$s in quadrilateral & $TA \perp OA$ & $TB \perp OB$)

$= 360° - 110° - 90° - 90°$

$= 70°$

16. (a) $x^2y \times x^5y^{-2}$

$= x^{2+5}\, y^{1-2}$

$= x^7 y^{-1}$

$= \frac{x^7}{y}$ #

(b) $\left(\frac{64}{x^{15}}\right)^{-\frac{1}{3}}$

$= \left(\frac{x^{15}}{64}\right)^{\frac{1}{3}}$

$= \left(\frac{x^{15}}{4^3}\right)^{\frac{1}{3}}$

$= \frac{x^5}{4}$ #

17. (a) No. of students who chose to go college

$= 180 - 72 - 42$

$= 66$

No. of female students who chose to go college

$= 66 - 34$

$= 32$ #

(b) Angle representing the males choosing polytechnic

$= \frac{28}{105} \times 360°$

$= 96°$ #

(c) In the group of males, $\frac{43}{105} \times 100\% = 40.952\%$ choose employment

In the group of females, $\frac{29}{75} \times 100\% = 38.667\%$ choose employment

$\therefore$ A greater percentage in the group of males choose employment.

$\therefore$ % of males who choose employment is greater than % of females who choose employment by

$40.952\% - 38.667\% = 2.286$

$\approx 2.29\%$ #

18 (a) $xy - 3x + 2y - 6$

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

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

(b) $6x^2 - 15x - 9$

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

$= 3(2x+1)(x-3)$ #

19 (a) deceleration $= \frac{18}{20}$

$= 0.9 \text{ m/s}^2$ #

(b) Total distance $= \frac{1}{2}(100+50)(18)$

$= 1350 \text{ m}$ #

(c) 18 m/s

$= \frac{18}{1000} \div \frac{1}{3600}$

$= 64.8 \text{ km/h}$ #

20. (a) $y = 10 - 2x$

when $x = 0$, $y = 10$. $\therefore P(0, 10)$ #

When $y = 0$, $2x = 10$

$x = 5$ $\therefore Q(5, 0)$ #

(b) $PQ^2 = OP^2 + OQ^2$

$= 10^2 + 5^2$

$PQ = \sqrt{100 + 25}$

$= 11.18$

$\approx \underline{11.2}$ units. (3 s.f.).

#

21. (a) Arc $PAQ = 16(2.5)$

$= 40$ cm #

(b) $2\pi r = 40$

$r = \frac{40}{2\pi}$

$= 6.3661$

≈ 6.37 cm (3 s.f.) #

(c) 2.5 radian $= \frac{2.5}{\pi} \times 180^\circ$

$= 143.23$

$\approx 143.2^\circ$ (1 d.p.)

22. (a) $\tan \hat{BCD} = \frac{8.5}{12}$

$\hat{BCD} = 35.311^\circ$

$\approx 35.3^\circ$ (1 d.p.) #

(b) $\sin 48^\circ = \frac{8.5}{AB}$

$AB = \frac{8.5}{\sin 48^\circ}$

$= 11.437$

≈ 11.4 cm (3 s.f.) #

23. (a) ΔABX is similar to ΔCDX

$\Rightarrow \frac{AB}{CD} = \frac{BY}{DX} = \frac{AX}{CX}$

$\frac{12}{CD} = \frac{6}{DX} = \frac{8}{12}$

$\Rightarrow \frac{12}{CD} = \frac{8}{12}$

$8CD = 144$

$CD = 18$ cm #

(b) $\Rightarrow \frac{6}{DX} = \frac{8}{12}$

$8DX = 72$

$DX = 9$

$\therefore AD = 9 + 8$

$= 17$ cm #

23 (c) $\frac{\text{Area of } \triangle ABX}{\text{Area of } \triangle CDX} = \left(\frac{AX}{CX}\right)^2$

$\frac{21.3}{\text{Area of } \triangle CDX} = \left(\frac{8}{12}\right)^2$

$\frac{21.3}{\text{Area of } \triangle CDX} = \frac{4}{9}$

$4 \text{ Area of } \triangle CDX = 21.3(9)$

$\text{Area of } \triangle CDX = \frac{21.3(9)}{4}$

$= 47.925 \text{ cm}^2$ #

24. (a) (i) $M = kr^2$

When $r = 4$ cm, $M = 720$ g,

$720 = k(4)^2$

$k = \frac{720}{16}$

$= 45$

$\therefore M = 45r^2$ *

(ii) When $r = 6$ cm,

$M = 45(6)^2$

$= 1620$ g *

(b) Let Radius of A be R_A and

Radius of B be R_B

$\Rightarrow R_A = 1.5 R_B$

$\frac{M_A}{M_B}$

$= \frac{45 R_A^2}{45 R_B^2}$

$= \frac{(1.5 R_B)^2}{R_B^2}$

$= \frac{(1.5)^2 R_B^2}{R_B^2} = \frac{9}{4}$

$\therefore$ Ratio $= 9 : 4$ *

25. (a) (i) $\overrightarrow{OM} = \frac{2}{3}\overrightarrow{OC}$

$= \frac{2}{3}(3\underset{\sim}{a} + 3\underset{\sim}{b})$

$= 2\underset{\sim}{a} + 2\underset{\sim}{b}$ #

(ii) $\overrightarrow{AM} = \overrightarrow{AO} + \overrightarrow{OM}$

$= -6\underset{\sim}{a} + 2\underset{\sim}{a} + 2\underset{\sim}{b}$

$= -4\underset{\sim}{a} + 2\underset{\sim}{b}$ #

(iii) $\overrightarrow{AN} = \overrightarrow{AO} + \overrightarrow{ON}$

$= -6\underset{\sim}{a} + 3\underset{\sim}{b}$ #

(b) $\overrightarrow{AM} = -4\underset{\sim}{a} + 2\underset{\sim}{b}$

$= -2(2\underset{\sim}{a} - \underset{\sim}{b})$

$\overrightarrow{AN} = -3(2\underset{\sim}{a} - \underset{\sim}{b})$

$\Rightarrow \overrightarrow{AM} = \frac{2}{3}\overrightarrow{AN}$

So A, M and N lie in a straight line.

(c) $\overrightarrow{AM} = \frac{2}{3}\overrightarrow{AN}$

$\frac{|\overrightarrow{AM}|}{|\overrightarrow{AN}|} = \frac{2}{3}$

$\frac{AM}{AN} = \frac{2}{3}$

$\Rightarrow AM : AN = 2 : 3$ #