**St. Paul's Secondary School**
**2020 – 2021 F.6 Mock Examination Marking Scheme**

**Section A**

1

$\frac{(p^{-3}q^2)^4}{p^{-5}q^4}$

$=\frac{p^{-12}q^8}{p^{-5}q^4}$

$=\frac{q^{8-4}}{p^{12-5}}$

$=\underline{\underline{\frac{q^4}{p^7}}}$

(3)

2 (a) $25a^2+20ab+4b^2$

$=\underline{\underline{(5a+2b)^2}}$

(b) $25a^2+20ab+4b^2-50a^2b+8b^3$

$=(5a+2b)^2-50a^2b+8b^3$ (by (a))

$=(5a+2b)^2-2b(25a^2-4b^2)$

$=(5a+2b)^2-2b(5a+2b)(5a-2b)$

$=(5a+2b)[5a+2b-2b(5a-2b)]$

$=\underline{\underline{(5a+2b)(5a+2b-10ab+4b^2)}}$

(3)

3 $\frac{3}{x-6}-\frac{4x}{5-8x}$

$=\frac{3(5-8x)-4x(x-6)}{(x-6)(5-8x)}$

$=\frac{15-24x-4x^2+24x}{(x-6)(5-8x)}$

$=\underline{\underline{\frac{15-4x^2}{(x-6)(5-8x)}}}$ (or $\underline{\underline{\frac{4x^2-15}{(x-6)(8x-5)}}}$)

4 **(a)** For $5(x+7)>3x+2$,

$5x+35>3x+2$

$2x>-33$

$x>-\frac{33}{2}$

For $x+4\geq 0$,

$x\geq -4$

$\therefore$ The required solution is $x>-\frac{33}{2}$.

**(b)** The least negative integer $=\underline{\underline{-16}}$

5 (a) $u+1=\frac{u+v+6}{v+1}$

$(u+1)(v+1)=u+v+6$

$uv+u+v+1=u+v+6$

$uv=5$

$u=\frac{5}{v}$

(b) Let $u'$ and $v'$ be the new values of $u$ and $v$ respectively. Then

$v'=(1+25\%)v=\frac{5}{4}v$

$\therefore\quad u'=\frac{5}{v'}=\frac{5}{\frac{5}{4}v}=\frac{4}{5}\left(\frac{5}{v}\right)=\frac{4}{5}u$

The percentage change in the value of $u$

$=\frac{u'-u}{u}\times 100\%$

$=\frac{\frac{4}{5}u-u}{u}\times 100\%$

$=-20\%$

$\therefore$ The value of $u$ is decreased by 20%.

(4)

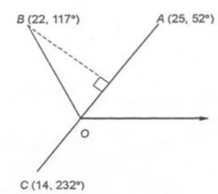
6 (a) $\angle AOC$

$=232°-52°$

$=180°$

$\therefore$ $A$, $O$ and $C$ are collinear.

(b) Consider the figure.




The required distance

$=OB\sin\angle AOB$

$=22\sin(117°-52°)$

$\approx 19.9388$

$=\underline{\underline{19.9}}$ *(cor. to 3 sig. fig.)*

(4)

7 **(a)** $\because$ The modes are 8 and 12.

$\therefore$ $a = 12$ or $b = 12$

$$\frac{4+7+8+8+9+12+13+16+a+b}{10} = 11$$

$$77 + a + b = 110$$

$$a + b = 33$$

If $a = 12$, $b = 33 - 12 = 21$

If $b = 12$, $a = 33 - 12 = 21$

$\because$ $a > b$

$\therefore$ $a = \underline{\underline{21}}$ and $b = \underline{\underline{12}}$

**(b)** The required probability

$= \frac{4}{10}$

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

8 Let $r$ cm and $x°$ be the radius and the angle of the sector respectively.

$$\begin{cases} 2\pi r\left(\frac{x}{360}\right) = 9\pi \text{.......(1)} \\ \pi r^2\left(\frac{x}{360}\right) = 54\pi \text{.......(2)} \end{cases}$$

$\frac{(2)}{(1)}$:

$r = 12$

Substituting $r = 12$ into (1),

$$2\pi(12)\left(\frac{x}{360}\right) = 9\pi$$

$$x = 135$$

$\because$ $90° < x° < 180°$

$\therefore$ The angle of the sector is an obtuse angle.

9 $AC : BC = 4 : 3$

Let $AC = 4k$ and $BC = 3k$.

$AB^2 = AC^2 + BC^2$ *(Pyth. theorem)*

$AB = \sqrt{(4k)^2 + (3k)^2}$

$= 5k$

$$\cos\angle ABC = \frac{BC}{AB}$$

$$\cos(180° - \theta) = \frac{3k}{5k}$$

$$-\cos\theta = \frac{3}{5}$$

$$\cos\theta = \underline{\underline{-\frac{3}{5}}}$$

$$\sin\angle ABC = \frac{AC}{AB}$$

$$\sin(180° - \theta) = \frac{4k}{5k}$$

$$\sin\theta = \underline{\underline{\frac{4}{5}}}$$

A2

**10** **(a)** Let $C=p+\frac{k}{N}$, where $p$ and $k$ are non-zero constants.

$$\begin{cases}\frac{2600}{200}=p+\frac{k}{200}\\ \frac{3000}{250}=p+\frac{k}{250}\end{cases}$$

$$\begin{cases}13=p+\frac{k}{200} \quad \text{.........(1)}\\ 12=p+\frac{k}{250} \quad \text{.........(2)}\end{cases}$$

(1) – (2):

$$1=\frac{k}{200}-\frac{k}{250}$$

$$k=1000$$

Substituting $k=1000$ into (1),

$$13=p+\frac{1000}{200}$$

$$p=8$$

$\therefore \quad C=8+\frac{1000}{N}$

When 400 copies are printed,

$$C=8+\frac{1000}{400}=10.5$$

Total cost $= \$10.5 \times 400$

$= \$4200$

**(b)** When 375 copies are printed,

$$C=8+\frac{1000}{375}=10\frac{2}{3}$$

Total cost $=\$10\frac{2}{3}\times 375$

$= \$4000$

Let $n$ be the number of copies needed to be sold out to avoid any loss.

$$n \times 18 \geq 4000$$

$$n \geq 222\frac{2}{9}$$

$\therefore$ At least 223 copies are needed to be sold out.

$\therefore$ The claim is not correct.

11. (a) $\because$ The gradient of Part II is the greatest.

$\therefore$ The average speed of Part II is the highest.

(2)

(b) (i) Let $x$ minutes and $y$ minutes be the time for Amy driving from $A$ to $C$ and $A$ to $B$ respectively.

$$\frac{40-0}{75-x}=\frac{75}{75}$$

$$75-x=40$$

$$x=35$$

$$\frac{75-40}{35-y}=\frac{55-40}{35-29}$$

$$175-5y=70$$

$$y=21$$

$\therefore$ At 9:21, Amy is at $B$.

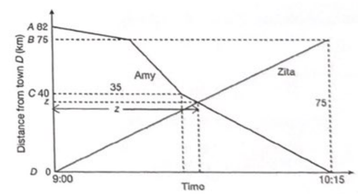
At 9:35, Amy is at $C$.

(ii) Let $z$ km be the distance between the location that Amy and Zita meet and $D$.

The time that Zita drives from $D$ to the location they meet

$$=\frac{z\text{ km}}{\frac{75\text{ km}}{75\text{ min}}}$$

$$=z\text{ min}$$




$$\frac{40-z}{z-35}=\frac{75}{75}$$

$$40-z=z-35$$

$$2z=75$$

$$z=37.5$$

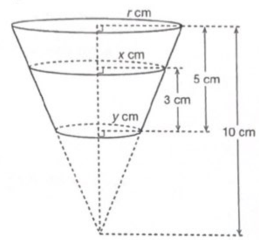
$\therefore$ The distance between the location that Amy and Zita meet and $D$ is 37.5 km.

(5)

12. (a) Volume of the conical jelly $= \frac{1}{3}\pi(10)^2(3.87)$ cm$^3$ $= \underline{\underline{129\pi \text{ cm}^3}}$

(1)

(b) Let $x$ cm and $y$ cm be the upper base radius and lower base radius of the lower part of the jelly formed respectively.




$\frac{r}{10} = \frac{x}{10-5+3}$ and $\frac{r}{10} = \frac{y}{10-5}$

$\frac{r}{10} = \frac{x}{8}$ and $\frac{r}{10} = \frac{y}{5}$

$x = \frac{4}{5}r$ and $y = \frac{1}{2}r$

Volume of the cone = Volume of the lower part of the frustum

$129\pi = \frac{1}{3}\pi(x)^2(8) - \frac{1}{3}\pi(y)^2(5)$

$129\pi = \frac{1}{3}\pi\left(\frac{4}{5}r\right)^2(8) - \frac{1}{3}\pi\left(\frac{1}{2}r\right)^2(5)$

$129 = \frac{128}{75}r^3 - \frac{5}{12}r^3$

$129 = \frac{129}{100}r^3$

$r^3 = 100$

$r = \underline{\underline{10}}$ or $-10$ (rejected)

Volume of the hemisphere

= Volume of the upper part of the frustum

$\frac{1}{2}\left(\frac{4}{3}\pi R^3\right) = \frac{1}{3}\pi r^2(10) - \frac{1}{3}\pi(x)^2(8)$

$\frac{2}{3}\pi R^3 = \frac{1}{3}\pi(10)^2(10) - \frac{1}{3}\pi\left(\frac{4}{5}\times 10\right)^2(8)$

$R^3 = 244$

$R = \underline{\underline{\sqrt[3]{244}}}$ (or 6.25)

Alternative method:

Ratio of vol of cones = 5^3:8^3:10^3

Ratio of vol. of smallest cone : lower frustum : upper frustum = 5^3 : 8^3 – 5^3 : 10^3 – 8^3

= 125 : 387 : 488

$\frac{488}{387} = \frac{\frac{1}{2}(\frac{4}{3}\pi R^3)}{\frac{1}{3}\pi 10^2(3.87)}$ $\therefore R = 6.25$

$\frac{1}{2}(\frac{4}{3}\pi R^3) = \frac{488}{1000}\frac{1}{3}\pi r^2(10)$ $\therefore R = 6.25$

$\therefore r = 10$

(5)

13. (a) (i) The locus of $P$ is a circle with centre $C$ and radius 4.

(ii) The equation of the locus of $P$:

$(x-3)^2 + [y-(-5)]^2 = 4^2$

$(x-3)^2 + (y+5)^2 = 16$

(or $x^2 + y^2 - 6x + 10y + 18 = 0$)

(2)

(b) (i) $L$ is perpendicular to $PC$ produced.

(ii) Slope of $L = -\frac{2}{-1} = 2$

$\therefore$ Slope of $PC$ produced $= -\frac{1}{2}$

The equation of $PC$ produced:

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

$x + 2y + 7 = 0$

By solving the simultaneous equations $\begin{cases} 2x-y+4=0 \\ x+2y+7=0 \end{cases}$, the coordinates of the point of intersection of $L$ and $PC$ produced are $(-3, -2)$.

$\therefore$ Required distance

$= \sqrt{[3-(-3)]^2 + [-5-(-2)]^2} - 4$

$= \underline{\underline{2.71}}$ *(cor. to 3 sig. fig.)* $(3\sqrt{5} - 4)$

(5)

14 (a) By the division algorithm,

$P(x) = (x^2 - x - 6)(3x + 1) + 3 - 2x$
$= 3x^3 + x^2 - 3x^2 - x - 18x - 6 + 3 - 2x$
$= \underline{\underline{3x^3 - 2x^2 - 21x - 3}}$

(b) (i) $f(-2) = P(-2) + R(-2)$
$= 3(-2)^3 - 2(-2)^2 - 21(-2) - 3 - 7$
$= 0$

By the factor theorem, $x + 2$ is a factor of $f(x)$.

$f(3) = P(3) + R(3)$
$= 3(3)^3 - 2(3)^2 - 21(3) - 3 + 3$
$= 0$

By the factory theorem, $x - 3$ is a factor of $f(x)$.

(ii) Let $R(x) = ax + b$, where $a$ and $b$ are constants.

$\begin{cases} -2a + b = -7 \text{..............(1)} \\ 3a + b = 3 \text{................(2)} \end{cases}$

(1) − (2):
$-5a = -10$
$a = 2$

Substituting $a = 2$ into (1),
$-2(2) + b = -7$
$b = -3$

$\therefore$ $R(x) = 2x - 3$

$\therefore$ $f(x) = P(x) + R(x)$
$= (x^2 - x - 6)(3x + 1) + 3 - 2x + 2x - 3$
$= (x - 3)(x + 2)(3x + 1)$

$\therefore$ $f(x) = 0$
$\underline{\underline{x = -2, -\frac{1}{3} \text{ or } 3}}$

**Section B**

**15. (a)** Let $\bar{x}$ and $h$ be the mean of the scores of the students in test 1 and the score of Catherine in test 1 respectively.

$\frac{41 - \bar{x}}{12} = -1.75$
$41 - \bar{x} = -21$
$\bar{x} = 62$
$\frac{h - \bar{x}}{12} = 1.5$
$h - 62 = 18$
$h = 80$

Difference between the scores of Verena and Catherine in test 1
$= 80 - 41$
$= 39$
$> 38$

Note that the range of the scores is at least the difference between the scores of Verena and Catherine.

$\therefore$ The range of the scores of the students in test 1 exceeds 38. ----------(3)

**(b) (i)** Score of Verena in test 2 = 20

Score of Catherine in test 2 = 80 − 10 = 70

Let $y$ and $\sigma$ be the mean and the standard deviation of the scores of the students in test 2 respectively.

$\frac{20 - y}{\sigma} = -2$
$20 - y = -2\sigma$ ..............................**(1)**
$\frac{70 - y}{\sigma} = 3$
$70 - y = 3\sigma$ ................................**(2)**

**(2)** − **(1)**: $50 = 5\sigma$
$\sigma = 10$

Substitute $\sigma = 10$ into **(2)**.
$70 - y = 3(10)$
$y = 40$

$\therefore$ The mean and the standard deviation of the scores of the students in test 2 are 40 and 10 respectively. +

(ii) The required mean

$= 40 \times 1.1 + 6$

$= \underline{\underline{50}}$

The required standard deviation

$= 10 \times 1.1$

$= \underline{\underline{11}}$

----------(5)

16

(a) $P$(two white balls are drawn from $B$)

$= P$(a white ball is drawn from $A$ and put into $B$) $\times$

$P$(two white balls are drawn from $B$ | a white ball is drawn from $A$ and put into $B$)

$= \frac{2}{6} \times \frac{C_2^2}{C_2^5}$

$= \underline{\underline{\frac{1}{30}}}$

Alternative method:

$\frac{2}{6} \times \frac{2}{5} \times \frac{1}{4}$

----------(2)

(b) $P$(two balls of the same colour are drawn from $B$)

$= P$(two white balls are drawn from $B$) $+ P$(two red balls are drawn from $B$)

$= \frac{1}{30} + P$(a white ball is drawn from $A$ and put into $B$) $\times$

$P$(two red balls are drawn from $B$ | a white ball is drawn from $A$ and put into $B$) $+$

$P$(a red ball is drawn from $A$ and put into $B$) $\times$

$P$(two red balls are drawn from $B$ | a red ball is drawn from $A$ and put into $B$)

$= \frac{1}{30} + \frac{2}{6} \times \frac{C_2^3}{C_2^5} + \frac{4}{6} \times \frac{C_2^4}{C_2^5}$

$= \underline{\underline{\frac{8}{15}}}$

Alternative method:

$\frac{1}{30} + \frac{2}{6} \times \frac{3}{5} \times \frac{2}{4} + \frac{4}{6} \times \frac{4}{5} \times \frac{3}{4}$

----------(2)

17. From the graph,

the slope$= \frac{3}{2}$

$\therefore \quad \log_2 y = \frac{3}{2}x + 3$

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

$y = 8 \cdot 2^{\frac{3}{2}x}$

Compare with $y = mn^x$,

$m = 8$

$n = 2^{\frac{3}{2}} = 2.83$ (cor to 3sig.

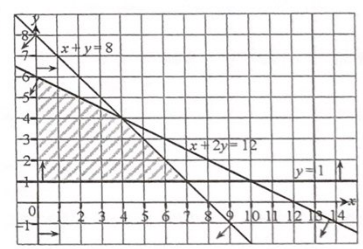
------(3)

18. (a) The constraints are $\begin{cases} x + y \le 8 \\ 75x + 150y \le 900 \\ y \ge 1 \\ x \ge 0 \end{cases}$,

i.e. $\underline{\begin{cases} x + y \le 8 \\ x + 2y \le 12 \\ y \ge 1 \\ x \ge 0 \end{cases}}$.

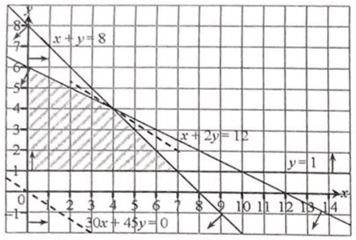
----------(2)

(b)




----------(2)

(c) (i)




Let the total net income of the centre earned through the tutorials conducted by John and Sandy on one day be $M.

Then $M = (105-75)x + (195-150)y$

$= 30x + 45y$

Draw the straight line $30x + 45y = k$, where $k$ is a constant.

From the graph, $M$ attains its maximum value at (4 , 4).

Maximum value of $M$ $= 30(4) + 45(4)$

$= 300$

∴ <u>The claim is disagreed.</u>

**Alternative Method**

Let the total net income of the centre earned through the tutorials conducted by John and Sandy on one day be $M.

Then $M = (105-75)x + (195-150)y$

$= 30x + 45y$

The vertices of the feasible region are (0 , 1), (7 , 1), (4 , 4) and (0 , 6).

At (0 , 1), $M = 30(0) + 45(1) = 45$.

At (7 , 1), $M = 30(7) + 45(1) = 255$.

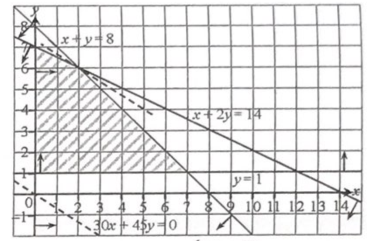
At (4 , 4), $M = 30(4) + 45(4) = 300$.

At (0 , 6), $M = 30(0) + 45(6) = 270$.

∴ $M$ attains its maximum value at (4 , 4) and the maximum value of $M$ is 300.

∴ <u>The claim is disagreed.</u>

(ii)




The new constraints are $\begin{cases} x+y\le 8 \\ 75x+150y\le 1050 \\ y\ge 1 \\ x\ge 0 \end{cases}$,

i.e. $\begin{cases} x+y\le 8 \\ x+2y\le 14 \\ y\ge 1 \\ x\ge 0 \end{cases}$.

From the graph, $M$ attains its maximum value at (2 , 6).

Maximum value of $M$ $= 30(2) + 45(6)$

$= 330$

$> 300$

∴ <u>The centre will get a higher maximum total net income on one day after the adjustment.</u>

**Alternative Method**

The vertices of the feasible region are (0 , 1), (7 , 1), (2 , 6) and (0 , 7).

At (0 , 1), $M = 30(0) + 45(1) = 45$.

At (7 , 1), $M = 30(7) + 45(1) = 255$.

At (2 , 6), $M = 30(2) + 45(6) = 330$.

At (0 , 7), $M = 30(0) + 45(7) = 315$.

∴ $M$ attains its maximum value at (2 , 6) and the maximum value of $M$ is 330.

∵ $330 > 300$

∴ <u>The centre will get a higher maximum total net income on one day after the adjustment.</u>

----------(5)

**19.** **(a)** $\angle BCD + \angle ABC = 180°$

$\angle BCD + 81° = 180°$

$\angle BCD = 99°$

$BM = MC = NC = DN = \frac{34}{2}$ cm = 17 cm

In $\triangle MCN$, by the cosine formula,

$MN^2 = MC^2 + NC^2 - 2 \times MC \times NC \times \cos \angle MCN$

$MN = \sqrt{17^2 + 17^2 - 2 \times 17 \times 17 \times \cos 99°}$ cm

$= \underline{25.9 \text{ cm}}$, *cor. to 3 sig. fig.* [25.854]

----------(2)

**(b)** In $\triangle ABM$, by the cosine formula,

$AM^2 = AB^2 + BM^2 - 2 \times AB \times BM \times \cos \angle ABM$

$AM = \sqrt{34^2 + 17^2 - 2 \times 34 \times 17 \times \cos 81°}$ cm

$= 35.555$ cm, *cor. to 5 sig. fig.*

By the sine formula,

$$\frac{AB}{\sin \angle AMB} = \frac{AM}{\sin \angle ABM}$$

$$\frac{34 \text{ cm}}{\sin \angle AMB} = \frac{35.555 \text{ cm}}{\sin 81°}$$

$$\sin \angle AMB = \frac{34 \sin 81°}{35.555}$$

$\angle AMB = \underline{70.8°}$ *or* 109° *(rejected)*, *cor. to 3 sig. fig.* [70.820]

**Alternative Method**

In $\triangle ABM$, by the cosine formula,

$AM^2 = AB^2 + BM^2 - 2 \times AB \times BM \times \cos \angle ABM$

$AM = \sqrt{34^2 + 17^2 - 2 \times 34 \times 17 \times \cos 81°}$ cm

$= 35.555$ cm, *cor. to 5 sig. fig.*

By the cosine formula,

$$\cos \angle AMB = \frac{BM^2 + AM^2 - AB^2}{2 \times BM \times AM}$$

$$= \frac{17^2 + 35.555^2 - 34^2}{2 \times 17 \times 35.555}$$

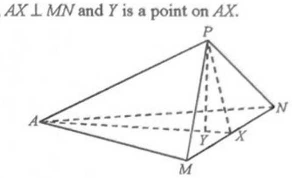
$\angle AMB = \underline{70.8°}$, *cor. to 3 sig. fig.* [70.820]

----------(2)

**(c)** **(i)** Let $X$ be the mid-point of $MN$ and $Y$ be the projection of $P$ on the plane $AMN$.

$\because$ $\triangle PMN$ and $\triangle AMN$ are isosceles triangles with $PM = PN$ and $AM = AN$.

$\therefore$ $PX \perp MN$, $AX \perp MN$ and $Y$ is a point on $AX$.




In $\triangle PMX$,

$PX^2 + MX^2 = PM^2$

$PX = \sqrt{PM^2 - MX^2}$

$= \sqrt{PM^2 - \left(\frac{1}{2} MN\right)^2}$

$= \sqrt{17^2 - \left(\frac{1}{2} \times 25.854\right)^2}$ cm

$= 11.041$ cm, *cor. to 5 sig. fig.*

In $\triangle AMX$,

$AX^2 + MX^2 = AM^2$

$AX = \sqrt{AM^2 - MX^2}$

$= \sqrt{35.555^2 - \left(\frac{1}{2} \times 25.854\right)^2}$ cm

$= 33.122$ cm, *cor. to 5 sig. fig.*

In $\triangle APX$, by the cosine formula,

$$\cos \angle AXP = \frac{AX^2 + PX^2 - AP^2}{2 \times AX \times PX}$$

$$= \frac{33.122^2 + 11.041^2 - 34^2}{2 \times 33.122 \times 11.041}$$

$\angle AXP = 85.061°$, *cor. to 5 sig. fig.*

In $\triangle PXY$,

$$\sin \angle PXY = \frac{PY}{PX}$$

$PY = 11.041 \sin 85.061°$ cm

$= 11.0$ cm, *cor. to 3 sig. fig.* [11.000]

$\therefore$ <u>The perpendicular distance from $P$ to the plane $AMN$ is 11.0 cm.</u>

**(ii)** In $\triangle AMN$,

$s = \frac{1}{2}(AM + AN + MN)$

$= \frac{1}{2}(35.555 + 35.555 + 25.854) = 48.482$ cm, *cor. to 5 sig. fig.*

By Heron's formula, area of $\triangle AMN$

$= \sqrt{s(s-AM)(s-AN)(s-MN)}$

$= \sqrt{48.482(48.482-35.555)(48.482-35.555)(48.482-25.854)}$ cm$^2$

$= 428.16$ cm$^2$, *cor. to 5 sig. fig.*

Volume of $PAMN$

$= \frac{1}{3} \times$ area of $\triangle AMN \times PY$

$= \frac{1}{3} \times 428.16 \times 11.000$ cm$^3$

$=$ <u>1 570 cm$^3$</u>, *cor. to 3 sig. fig.*

**Alternative Method**

In $\triangle AMN$,

$\cos \angle MAN = \frac{AM^2 + AN^2 - MN^2}{2 \times AM \times AN} = \frac{35.555^2 + 35.555^2 - 25.854^2}{2 \times 35.555 \times 35.555}$

$\angle MAN = 42.640°$, *cor. to 5 sig. fig.*

Area of $\triangle AMN$

$= \frac{1}{2} \times AM \times AN \times \sin \angle MAN$

$= \frac{1}{2} \times 35.555 \times 35.555 \times \sin 42.640°$ cm$^2$

$= 428.16$ cm$^2$, *cor. to 5 sig. fig.*

Volume of $PAMN$

$= \frac{1}{3} \times$ area of $\triangle AMN \times PY$

$= \frac{1}{3} \times 428.16 \times 11.000$ cm$^3$

$=$ <u>1 570 cm$^3$</u>, *cor. to 3 sig. fig.*

**(iii)** The angle between $PQ$ and the plane $AMN$ is $\angle PQY$.

$\sin \angle PQY = \frac{PY}{PQ}$ and $PY$ is a constant. (or use $\tan \angle PQY$ )

Let $Z$ be a point on $AM$ such that $PZ \perp AM$.

$PQ$ becomes shorter when $P$ moves from $A$ to $Z$ and it becomes longer when $P$ moves from $Z$ to $M$.

Therefore, $\sin \angle PQY$ becomes larger when $P$ moves from $A$ to $Z$ and it becomes smaller when $P$ moves from $Z$ to $M$.

$\therefore$ <u>When $Q$ moves from $A$ to $Z$, the angle between $PQ$ and the plane $AMN$ increases. When $Q$ moves from $Z$ to $M$, the angle between $PQ$ and the plane $AMN$ decreases.</u>

**End of Marking Scheme**

42. A row is formed by 5 girls and 5 boys. If the boys and girls stand alternately, how many different rows can be formed?

A. 60 480
B. 28 800
C. 14 400
D. 504

43. In a computer game, the probability that Peter will win is 0.6. If he plays the game 4 times, find the probability that he will win exactly twice.

A. 0.0576
B. 0.1728
C. 0.3456
D. 0.6912

44. In a quiz, Mary and John got 21 marks and 87 marks respectively. It is given that the standard scores of Mary and John in the quiz are $-1$ and 0.5 respectively. Find the mean mark of the quiz.

A. 39
B. 43
C. 54
D. 65

45. Let $m_1$, $r_1$ and $v_1$ be the mean, the range and the variance of a group of distinct numbers $\{x_1, x_2, x_3, \dots, x_{80}\}$ respectively. If $m_2$, $r_2$ and $v_2$ are the mean, the range and the variance of a group of numbers $\{x_1 + 2, x_2 + 2, x_3 + 2, \dots, x_{80} + 2, m_1 + 2\}$ respectively, which of the following must be true?

I. $r_2 > r_1$
II. $m_2 > m_1$
III. $v_2 > v_1$

A. I only
B. II only
C. I and III only
D. II and III only

**End of Paper**



| | | |
|---|---|---|
| 1 D | 16 C | 31 C |
| 2 A | 17 C | 32 A |
| 3 B | 18 A | 33 A |
| 4 C | 19 B | 34 D |
| 5 A | 20 C | 35 B |
| 6 B | 21 D | 36 A |
| 7 A | 22 D | 37 D |
| 8 D | 23 B | 38 C |
| 9 C | 24 C | 39 B |
| 10 D | 25 A | 40 C |
| 11 B | 26 D | 41 D |
| 12 A | 27 A | 42 B |
| 13 B | 28 C | 43 C |
| 14 C | 29 A | 44 D |
| 15 D | 30 B | 45 B |