Diocesan Boys' School
2021-2022 Grade 12 Mock Examination
Mathematics Compulsory Part
Paper 2

Suggested Solution

1. D

$$= \frac{3^{4m} \cdot 3^{4m}}{3^{6m}}$$
$$= 3^{2m}$$

2. D

$$-pq - p^2 = -3p + 3q$$
$$3p - p^2 = 3q + pq$$
$$\frac{3p - p^2}{3 + p} = q$$
$$q = \frac{p(3-p)}{3+p}$$

3. C

$$= (2-q)(p+2q)(-2)(p-2q)$$
$$= (-4+2q)(p^2-4q^2)$$
$$= -4p^2 + 16q^2 + 2p^2q - 8q^3$$

4. A

$$= \frac{-3(6-x) - 5(x-4)}{(x-4)(6-x)}$$
$$= \frac{-18 + 3x - 5x + 20}{(x-4)(6-x)}$$
$$= \frac{-2(x-1)}{(x-4)(6-x)}$$

5. C

Sub $x = -2$
$-3a + c = 0$
$3a = c$
$a : c = 1 : 3$

6. D

$$= 3(\beta-1)^2 - \alpha(\beta-1) + 1$$
$$-3(\beta+1)^2 + \alpha(\beta+1) - 1$$
$$= 3(-2\beta - 2\beta) + 2\alpha$$
$$= -12\beta + 2\alpha$$

7. D

$p(x) = (x^2-4)q(x) + ax + b$

$$\begin{cases} p(-2) = 8 \\ p(2) = 0 \end{cases}$$
$$\Rightarrow \begin{cases} -2a + b = 8 \\ 2a + b = 0 \end{cases}$$
$$\Rightarrow \begin{cases} a = -2 \\ b = 4 \end{cases}$$

8. C

no. of foreigners
$= 150(20\%)$
$= 30$

no. of female foreigners
$= 30 - 12$
$= (1 - 75\%)(\text{no. of female})$

no. of female
$= 72$

no. of male
$= 150 - 72$
$= 78$

no. of local male
$= 78 - 12$
$= 66$

9. C

$1 - 2x \geq 3x - 9$ or $-7x \geq 14$
$10 \geq 5x$ $x \leq -2$
$x \leq 2$

$\Rightarrow x \leq 2$

10. C

$16p+12r=6p+27r$

$10p=15r$

$2p=3r$

$p:r=3:2=9:6$

$q:r=4:3=8:6$

$p:q:r=9:8:6$

$(p+q):(q-r)=17:2$

11. D

$v=\dfrac{k\sqrt{x}}{y^2}$

$v'=\dfrac{k\sqrt{1.21x}}{0.1^2y^2}=110v$

% change

$=\left(\dfrac{110v-v}{v}\right)(100\%)$

$=10900\%$

12. C

$a_7=2a_5-a_6$

$a_7=10-a_6$

$a_6=10-a_7$

$a_8=2a_6-a_7$

$-7=2(10-a_7)-a_7$

$a_7=9$

13. A

$S>2.5\cdot3.5+[(3.5-1.5)+3.5](4.5-2.5)\left(\dfrac{1}{2}\right)$

$S>14.25$

and

$S<3.5\cdot4.5+[(4.5-0.5)+4.5](5.5-3.5)\left(\dfrac{1}{2}\right)$

$S<24.25$

14. C

I: False

Sum of root $=0+10=\dfrac{-b}{a}$

$\Rightarrow ab<0$

II: True

$c=0$

III: True

Sub (10,0)

$0=100a+10b+0$

$0=10a+b$

$\because a<0$

$\therefore 8a+b>0$

15. C

$h^2=25^2-(20^2+9^2)$

$h=12$

Total surface area

$=(20)(9)(2)+(20+9)(2)(12)$

$=1056$

16. A

$\pi(8k)^2+\pi(8k)(17k)=50\pi$

$200k^2=50$

$k=0.5$

$r=4$

$l=\dfrac{17}{2}$

$h=\sqrt{l^2-r^2}=7.5$

Volume

$=\pi(4^2)(7.5)\left(\dfrac{1}{3}\right)$

$=40\pi$

17. A

In ΔDCO

$\cos\angle DOC = \dfrac{r}{2r}$

$\angle DOC = 60°$

$\sin 60° = \dfrac{6\sqrt{3}}{DO}$

$DO = 12$

$60° + \angle OBA = 105°$

$\angle OBA = 45°$

$\angle OAB = 45°$

In ΔAEO

$45° + 105° + \angle EOA = 180°$

$\angle EOA = 30°$

Area

$= \pi(12)^2\left(\dfrac{30°}{360°}\right)$

$= 12\pi$

18. C

$\Delta BCE \cong \Delta DCF$ (S.A.S.)

$\Delta AEC \cong \Delta AFC$ (S.S.S.)

$\angle EAF + 80° = 180°$

$\angle EAF = 100°$

$\angle AEC + \dfrac{100°}{2} + \dfrac{42°}{2} = 180°$

$\angle AEC = 109°$

19. D

I: True

$\because$ Symmetry

$\Rightarrow$ Congruent

II: True

$\because$ Regular

$\therefore FE // AH$ and $AF // HE$

$\therefore AH // HD$

$\Rightarrow FE = HD$

$\because \angle FIE = \angle HID$ vert.opp $\angle$s

$\because \angle FEI = \angle IHD$ alt$\angle s, FE // AD$

$\therefore \Delta EFI \cong \Delta HDI$ A.A.S.

$\therefore \Delta EFI \cong \Delta HDI \cong \Delta HBG$

III. True

$\because \angle FGA = \angle EID = 90°$

$\because AF = DE$

$\because \angle FAG = \angle IED$

A.A.S.

20. C

Consider the area of

$\Delta DBE : \Delta ABC = 2^2 : (2+3)^2$

$\Delta DBE = 72$

$\Delta DBE : \Delta ADF = 2^2 : 3^2$

$\Delta ADF = 162$

$\Delta ECF = 450 - 72 - 162 = 216$

21. D

I: False

$HC \neq CF$

II: True

III: True

$\angle GCD = \dfrac{(5-2)(180°) - 3(140°)}{2} = 60°$

$\angle ICH = \dfrac{180° - 140°}{2} = 20°$

22. C

$\angle BAE + 68° = 180°$

$\angle BAE = 112°$

$\angle EBD + 68° + 90° = 180°$

$\angle EBD = 22°$

$\angle AEB = \angle EBD = 22°$

$\angle ABE + 112° + 22° = 180°$

$\angle ABE = 46°$

$\angle ACE = \angle ABE = 46°$

23. D

$R : (-5,-1)$

$Q : (1,-5)$

$P : (5,-5)$

24. A

$\cos\alpha = \dfrac{3k+5k}{CE}$

$CE = \dfrac{8k}{\cos\alpha}$

$\cos\beta = \dfrac{k+3k}{DF}$

$DF = \dfrac{4k}{\cos\beta}$

$CE : DF = \dfrac{8k}{\cos\alpha} : \dfrac{4k}{\cos\beta} = 2\cos\beta : \cos\alpha$

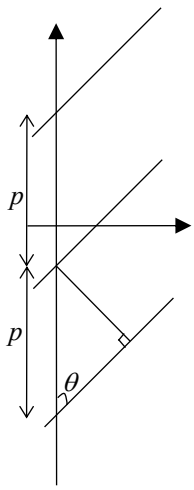
25. B

$\tan\theta = a$

$\theta = 45°$

$\sin\theta = \dfrac{\sqrt{2}}{p}$

$p = 2$



26. B

I: True

$L_1 : y = -\dfrac{1}{a}x - 1$

$-\dfrac{1}{a} > 0$

$a < 0$

II: False

$L_2 : y = -cx - b$

$-1 = -b$

$b = 1 \neq a$

III: True

$PQ > 2OP$

$OQ > OP$

$\dfrac{1}{c} > -a$

$1 > -ac \qquad \because c > 0$

$ac > -1$

27. D

$H : (2,-1)$

$K : (2,4)$

A: False

Put (0,0)

$LHS = 55 > 0$

B: False

$3 = \sqrt{2^2 + 1^2 + 4} > \sqrt{2^2 + 4^2 - \dfrac{55}{4}} = 2.5$

C: False

$HK = 5 \neq 5.5 = (3 + 2.5)$

D: True

$\left(m_{OH}\right)\left(m_{OK}\right) = \left(\dfrac{-1}{2}\right)\left(\dfrac{4}{2}\right) = -1$

28. B

$0 \le b \le 4$

$p = \dfrac{4}{20} = 0.2$

29. A

A: True

$IQR = 26 - 20 = 6$

B: Cannot be determined

C: False

Consider $16, 20, 24, 26, 30$

Less than \$24: $= \frac{2}{5}$

D: False

Consider $16, 20, 24, 26, 30$

More than \$26: $= \frac{1}{5} = 20\%$

30. D

All True

31. B

Third Expression:

Coeff : $1, 2, 3, 6$

Power of x : $2, 3, 4$

Power of y : 2

Power of z : 0

32. B

$= 8^{10} + 7(8) + 12(16^8) + 14(16)$

$= 2^{30} + 7(2^3) + 3(2^{34}) + 7(2^5)$

$= 2^{30} + 48(2^{30}) + 7(2^3) + 28(2^3)$

$= 49(2^{30}) + 35(2^3)$

33. B

I: True

Consider $x = 1$,

$a > b$

II: True

Put $y = c$,

$x_B = \frac{\log c}{\log b}$

$BC = -\frac{\log c}{\log b}$

$x_A = \frac{\log c}{\log a}$

$AC = \frac{\log c}{\log a}$

Note that $0 < b < 1 < a$

$BC > AC > 0$

$-\frac{\log c}{\log b} > \frac{\log c}{\log a} > 0$

$-\log a < \log b < 0$

$-1 < \log_a b < 0$

$a^{-1} < b < a^0$

$1 < ab < 0$

III: False

$\frac{AC}{BC}$

$= \frac{\log c}{\log a} \div \left(-\frac{\log c}{\log b} \right)$

$= -\frac{\log b}{\log a}$

$= -\log_a b$

34. A

$\log_4 y = \log_4 8 + \log_4 \sqrt{x}$

$\log_4 y = \frac{3}{2} + \frac{1}{2}\log_4 x$

$\text{vertical\_int} = \frac{3}{2}$

$\text{horizontal\_int} = -3$

$\text{Product} = -\frac{9}{2}$

35. A

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

$= -1 + \frac{5ai(2-i)}{4-(-1)}$

$= -1 + 2ai + a$

36. B

I: False

$T(2) - T(1) = 2a \neq a = T(3) - T(2)$

II: True

$2\log a,\ 3\log a,\ 4\log a$

III: False

when $a = 90°$

37. B

Least value at (3,6)

$= 11(3) - 5(6) = 3$

38. B

$CE^2 = 20^2 + 20^2 - 2(20^2)\cos 108°$

$CE = 32.36067977$

$CG^2 = 20^2 + CE^2 - 2(20)(CE)\cos 18°$

$CG = 14.70170673$

$20^2 = CG^2 + CE^2 - 2(CG)(CE)\cos \angle ECG$

$\angle ECG = 24.85873723$

$\angle EIC$

$= 180° - 36° - \angle ECG$

$= 119.1412328°$

$\frac{CI}{\sin 36°} = \frac{CE}{\sin \angle EIC}$

Area

$= \left(\frac{1}{2}\right)(CI)(CE)\sin \angle ECG$

$= 148.1305253$

39. B

$\overset{\frown}{BC} : \overset{\frown}{CD} : \overset{\frown}{AD} = 3 : 6 : 9$

Let

$\angle BAC = x$

$\angle CAD = 2x$

$\angle ACD = 3x$

$\angle BCD + \angle DAB = 180°$

$(90° + 3x) + (2x + x) = 180°$

$x = 15°$

$\angle AEC = \angle BAC = x$

$46° + 3x + 2x + \angle DAE + x = 180°$

$\angle DAE = 44°$

40. B

In ΔPQR,

$$PR = \frac{PQ}{\sin 45^\circ} = \frac{2PQ}{\sqrt{2}}$$

$$QR = \frac{PQ}{\tan 45^\circ} = PQ$$

In ΔPQS,

$$PS = \frac{PQ}{\sin 60^\circ} = \frac{2PQ}{\sqrt{3}}$$

$$QS = \frac{PQ}{\tan 60^\circ} = \frac{PQ}{\sqrt{3}}$$

In ΔQRS,

$$RS^2 = QR^2 + QS^2 - 2(QR)(QS)\cos 120^\circ$$

$$RS^2 = (PQ^2)\left[1 + \frac{1}{3} - 2\left(\frac{1}{\sqrt{3}}\right)\cos 120^\circ\right]$$

$$RS^2 = (PQ^2)(1.910683603)$$

In ΔPRS,

$$RS^2 = PR^2 + PS^2 - 2(PR)(PS)\cos\angle RPS$$

$$RS^2 = PQ^2 \cdot \left[\frac{4}{2} + \frac{4}{3} - 2\left(\frac{2}{\sqrt{2}}\right)\left(\frac{2}{\sqrt{3}}\right)\cos\angle RPS\right]$$

$$\angle RPS \approx 64^\circ$$

41. B

$$\left(-\frac{4}{3}\right)\left(\frac{0-\frac{3}{2}}{r_x - 0}\right) = -1$$

$$r_x = -2$$

42. A

P(win at the first draw)

$$= \frac{1}{2} + \left(\frac{1}{2}\right)\left(\frac{4}{8}\right) = \frac{3}{4}$$

P(Lok win)

$$= \left(\frac{1}{4}\right)\left(\frac{3}{4}\right) + \left(\frac{1}{4}\right)^3\left(\frac{3}{4}\right) + \left(\frac{1}{4}\right)^5\left(\frac{3}{4}\right) + \ldots$$

$$= \left(\frac{1}{4}\right)\left(\frac{3}{4}\right)\left[1 + \left(\frac{1}{4}\right)^2 + \left(\frac{1}{4}\right)^4 + \left(\frac{1}{4}\right)^6 + \ldots\right]$$

$$= \left(\frac{3}{16}\right)\left[\frac{1}{1 - \frac{1}{16}}\right]$$

$$= \frac{1}{5}$$

43. D

$$\frac{\left(\frac{6}{11}\right)\left(\frac{5}{10}\right)\left(\frac{4}{9}\right)\left(\frac{3}{8}\right)\left(\frac{5}{7}\right)}{\left(\frac{6}{11}\right)\left(\frac{5}{10}\right)\left(\frac{4}{9}\right)} = \frac{15}{56}$$

44. A

$$\frac{70 - \mu}{x} = 0.8$$

$$\mu = 70 - 0.8x$$

$$\frac{D - \mu}{x} = -1.2$$

$$D = \mu - 1.2x$$

$$D = 70 - 0.8x - 1.2x$$

45. A

I: False

$x_1 = a + 24d$

$x_2 = a + 24.5d$

d can be negative

II: True

$x_2 = a + 24.5d = y_2$

III: False

if $d = 0$,

$z_1 = z_2$