2019 VCE Mathematical Methods 2 (NHT) examination report

Specific information

This report provides sample answers or an indication of what answers may have included. Unless otherwise stated, these are not intended to be exemplary or complete responses.

Section A – Multiple-choice questions

Question	Answer	Comments
1	B	
2	E	
3	D	
4	A	$y=\frac{2x-3}{4+x}=2-\frac{11}{x+4}$, the asymptotes are $y=2$ and $x=-4$
5	A	
6	D	$f(x)=x^2+1$, solve $f(f(x))=\frac{185}{16}$ for x, $x=\pm\frac{3}{2}$, domain $x\geq 0$, $x=\frac{3}{2}$
7	D	
8	D	Solve $\frac{m-1}{3}=\frac{2}{m}$ for m for the lines to be parallel, $m=-2$ or $m=3$, $\frac{2}{m}=\frac{2}{k}, m=k$ for an infinite number of solutions, $m=-2$ and $k=-2$
9	C	
10	C	
11	E	
12	D	
13	E	
14	A	Solve $2\log_e(x)-\log_e(x+2)=\log_e(y)$ for x, $x=\frac{y\pm\sqrt{y(y+8)}}{2}$, where $x>0$ and $y>0$, $x=\frac{y+\sqrt{y(y+8)}}{2}$
15	B	
16	E	
17	B	
18	B	$A=\int_0^4\left(8-2^{x-1}-\left(-\frac{15}{8}x+\frac{15}{2}\right)\right)dx=17-\frac{15}{2\log_e(2)}$

Question	Answer	Comments
19	C	$p = 0.74075,\ 1.96\sqrt{\frac{0.74075(1-0.74075)}{n}} = 0.8147 - 0.74075$, n = 135
20	C	$g(x) = f^{-1}(x) = \frac{x^{\frac{1}{5}} - b}{a},\ g'(x) = \frac{x^{-\frac{4}{5}}}{5a},\ g'(1) = \frac{1}{5a}$

Section B

Question 1a.

$c = 2,\ d = 64$

Question 1b.

$(-\infty, -2) \cup (2,\ \infty)$

Question 1ci.

$\left(-\frac{1}{2},\ 1\right) \cup (1,\ \infty)$

Question 1cii.

$(-\infty, -2) \cup \left(-2, -\frac{1}{5}\right) \cup (1, \infty)$

Question 1d.

$f(1+m) = m^3(m+3)^3,\ f(-2-m) = (-m-3)^3(-m)^3 = m^3(m+3)^3,\ \text{so } f(1+m) = f(-2-m)$

Question 1e.

$-2 < h \leq 1$

Question 1f.

$k > \frac{729}{64}$

Question 2a.

amplitude = 16, period = 28

Question 2b.

minimum = 4, maximum = 36

Question 2c.

$v(60) = 32.5093$ km/h, correct to four decimal places

Question 2d.

Average wind speed = $\frac{1}{60}\int_0^{60}\left(v(t)\right)dt = \frac{1}{60}\int_0^{60}\left(20+16\sin\left(\frac{\pi t}{14}\right)\right)dt = 20.45$ km/h, correct to two decimal places

Question 2e.

$v(60) = v_1(60),\ k = 3.4358$, correct to four decimal places

Question 2fi.

$t = 60.75$ minutes, correct to two decimal places

Question 2fii.

$t = 60.748...$ to $t = 65.123...$, $\frac{65.123... - 60.748...}{14} \times 100\% = 31\%$ of a cycle, correct to the nearest whole per cent

Question 2g.

$a = \frac{1}{2},\ b = \frac{9}{8},\ c = k,\ d = \frac{11}{2}$

Question 3a.

$\Pr(L < 0) = 0.0062$, correct to four decimal places

Question 3b.

$\Pr(L > 15) = 0.1056$, correct to four decimal places

Question 3ci.

c	0	100	200
$\Pr(C = c)$	0.006	0.888	0.106

Question 3cii.

$E(C) = 100 \times 0.8881... + 200 \times 0.1062... = \$110$, correct to the nearest dollar

Question 3ciii.

$\text{sd}(C) = \sqrt{100^2 \times 0.8881... + 200^2 \times 0.1062... - (109.94...)^2} = \$32$, correct to the nearest dollar

Question 3di.

(0.030, 0.056), correct to three decimal places

Question 3dii.

The proportion of concerts that begin more than 15 minutes late for the Mathsland Concert Hall is outside the sample confidence interval.

Question 3e.

$$E(M)=\int_0^{\infty}(x\times f(x))dx=2$$

Question 3fi.

$$\int_{15}^{\infty}(f(x))dx=\frac{4}{289}$$

Question 3fii.

$\left(\frac{285}{289}\right)^9\times\frac{4}{289}=0.0122$, correct to four decimal places

Question 3fiii.

$\Pr(M<20\,|\,M>15)=\left(\frac{\Pr(15<M<20)}{\Pr(M>15)}\right)=0.403$, correct to three decimal places

Question 4a.

$A=2\int_0^2(f(x))\,dx=8$ square units

Question 4b.

$100\ 000\times 4+120\ 000\times 4=\$880\ 000$

Question 4c.

$a=1$

Question 4d.

$$x=\frac{8a+4\pm 4\sqrt{a^2+a+1}}{3a+3}$$

Question 4e.

$p\left(\frac{8a+4+4\sqrt{a^2+a+1}}{3a+3}\right)=-4,\ a=0.716$, correct to three decimal places

Question 4f.

$$A=\int_0^{4-\frac{4}{1+a}}(p(x))\,dx-\int_{4-\frac{4}{1+a}}^{4}(p(x))\,dx=\frac{64(1+2a+2a^3+a^4)}{3(1+a)^4},\ A'(a)=0,\ a=1$$

Question 4g.

$C(a)=1.2A_p+A_n,\ C'(a)=0,\ a=0.886$, correct to three decimal places

Question 5a.

$g^{-1}(x) = e^{\frac{x}{2}}$

Question 5b.

$f'(x) = 1,\ (2\log_e(2),\ 2)$

Question 5c.

$(2\log_e(2),\ 2),\ m = -1,\ y - 2 = -(x - 2\log_e(2)),\ y = -x + 2\log_e(2) + 2$

Question 5d.

$(2,\ 2\log_e(2))$

Question 5e.

$$A = \int_0^1 (f(x))\,dx + \int_1^{2\log_e(2)} (f(x) - g(x))\,dx + \int_{2\log_e(2)}^2 ((-x + 2\log_e(2) + 2) - g(x))\,dx$$

$= -2(\log_e(2))^2 - 4\log_e(2) + 6$ square units

Question 5f.

$p(x) = q(x) = x,\ p'(x) = q'(x) = 1,\ k = \frac{1}{e}$

Question 5g.

$k = 1$