2017 Nat 5 Paper 1

(1) $f(-5) = (-5)^2 + 3(-5)$

$= 25 - 15$

$= \underline{10}$

(2)

198 216 (218) 230 232 247 248 (250) 265 267

Q_1 ↑ Q_2 Q_3

$SIQR = \frac{1}{2}(250 - 218)$

$= \frac{1}{2}(32)$

$= \underline{16}$

(3) $1\frac{5}{6} \div \frac{3}{4} = \frac{11}{6_3} \times \frac{4^2}{3}$

$= \underline{\frac{22}{9}}$

(4)

	x^2	$-4x$	$+1$
$2x$	$2x^3$	$-8x^2$	$+2x$
$+3$	$+3x^2$	$-12x$	$+3$

$\therefore \underline{2x^3 - 5x^2 - 10x + 3}$

(5) $B = (0, 6, 6)$

$C = (3, 3, 9)$

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

$= \frac{8}{-4}$

$= -2$

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

$y - 6 = -2(x + 1)$

$y - 6 = -2x - 2$

$\underline{y = -2x + 4}$

(7) $A = \frac{1}{2} ab \sin C$

$= \frac{1}{2}(12)(8)\left(\frac{2}{3}\right)$

$= 6(8)\left(\frac{2}{3}\right)$

$= 48 \times \frac{2}{3}$

$= \underline{32 \text{ cm}^2}$

(8) $19 + x > 15 + 3(x - 2)$

$19 + x > 15 + 3x - 6$

$x - 3x > 9 - 19$

$-2x > -10$

$\underline{x < 5}$

(9) Triangle AOB is right-angled at B.

$\angle OBD = 32°$

Triangle OBD is isosceles

$\therefore \angle BOD = 180° - 2 \times 32°$

$= 116°$

$\therefore \angle BOA = 180° - 116°$

$= 64°$

$\therefore \underline{\angle CAB = 26°}$

(10) $\frac{t^2 + 4b}{c} = F$

$t^2 + 4b = cF$

$4b = cf - t^2$

$\underline{b = \frac{cf - t^2}{4}}$

(11) $\frac{3}{a^2} - \frac{2}{a} = \frac{3}{a^2} - \frac{2a}{a^2} = \underline{\frac{3 - 2a}{a^2}}$

(12)

x	$x-\bar{x}$	$(x-\bar{x})^2$
1	−3	9
4	0	0
6	2	4
3	−1	1
6	2	4
20	0	18

$\bar{x} = \frac{20}{5}$

$= 4$

$s = \sqrt{\frac{18}{4}}$

$= \frac{\sqrt{18}}{2}$

$= \frac{\sqrt{9}\sqrt{2}}{2}$

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

$\therefore a = 3 \quad b = 2$

(13) $x + 3y = 19$ (1)

$3x - y = 2$ (2)

(2) ×3 $9x - 3y = 6$ (3)

$x + 3y = 19$ (1)

(3) + (1) $10x = 25$

$x = 2.5$

$2.5 + 3y = 19$

$3y = 16.5$

$y = 5.5$

$\therefore (2.5, 5.5)$

(14) a) $a = 5$

b) $y = (x+5)^2 + b \quad (-3, 8)$ (x, y)

$\therefore 8 = (-3+5)^2 + b$

$8 = 2^2 + b$

$b = 4$

(15) Triangles PTS and PQR are similar.

$\therefore \frac{PS}{PR} = \frac{ST}{QR}$

$\frac{x}{x+2.6} = \frac{5}{7}$

$7x = 5(x+2.6)$

$7x = 5x + 13$

$2x = 13$

$x = 6.5 \text{ cm}$

Paper 2

(1) $|\underline{v}| = \sqrt{18^2 + (-14)^2 + 3^2}$

$= 23$

(2) $+4.5 \rightarrow 104.5\%$

$= 1.045$

1200×1.045^3

$= 1369.39935$

$\therefore £1369$ (nearest £)

(3) $p^2 = 250^2 + 180^2 - 2(250)(180)\cos 167$

$= 170380.3511$

$p = \sqrt{170380.3511}$

$= 412.77\ldots$

$\therefore$ Force $= 413 \text{ N}$

(4) $a=2$, $b=5$, $c=-4$

$$x=\frac{-5\pm\sqrt{5^2-4(2)(-4)}}{2(2)}$$

$$=\frac{-5\pm\sqrt{57}}{4}$$

$=0.63\ldots$ or -3.13

$=0.6$ or -3.1

(5)

%	Tickets
115	4830
1	42
100	4200

4200 tickets

(6) Volume = Vlarge − Vsmall

$$=\frac{4}{3}\pi(12)^3-\frac{4}{3}\pi(9)^3$$

$=7238.229\ldots-3053.628\ldots$

$=4184.601\ldots$

$=4180\ mm^3$ (3 sf)

(7) $16+6=22$

$22^2=484$

$8^2+19^2=425$

$22^2\neq 8^2+19^2$, so the larger triangle is not right-angled.

(8) a) $\overrightarrow{PR}=\overrightarrow{PQ}+\overrightarrow{QR}$

$=\underline{d}+(-\underline{c})$

$=\underline{d}-\underline{c}$

b) $\overrightarrow{TV}=\overrightarrow{TP}+\overrightarrow{PV}$

$=\overrightarrow{PQ}+\frac{1}{2}\overrightarrow{PR}$

$=\underline{d}+\frac{1}{2}(\underline{d}-\underline{c})$

$=\underline{d}+\frac{1}{2}\underline{d}-\frac{1}{2}\underline{c}$

$=\frac{3}{2}\underline{d}-\frac{1}{2}\underline{c}$

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

b) $2x^2-x-10$

	x	$+2$
$2x$	$2x^2$	$+4x$
-5	$-5x$	-10

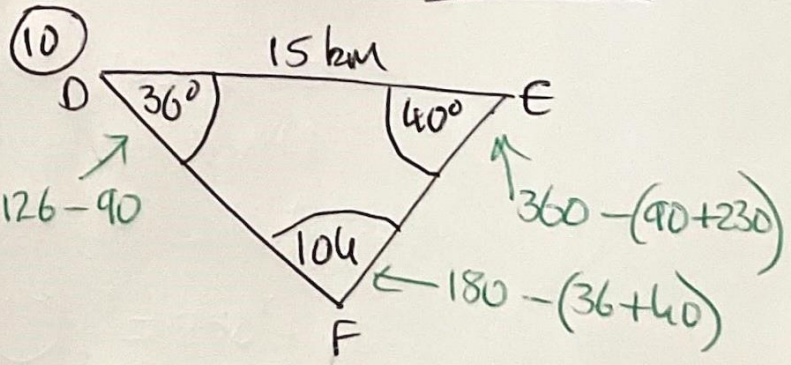
$\therefore(2x-5)(x+2)$

$\therefore\frac{4x^2-25}{2x^2-x-10}=\frac{(2x-5)(2x+5)}{(2x-5)(x+2)}$

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

20: 1 20, 2 10, (4 5)

(10)



$\frac{e}{\sin 40}=\frac{15}{\sin 104}$

$\therefore e=\frac{15\sin 40}{\sin 104}=9.9\ km$

(11) $3x - 5y - 10 = 0$

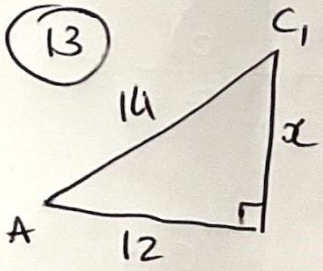
$3x - 10 = 5y$

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

$\therefore m = \frac{3}{5}$

(12) $\frac{1}{\sqrt[3]{x}} = \frac{1}{x^{1/3}} = x^{-1/3}$

(13)



$x^2 = 14^2 - 12^2$

$= 52$

$x = \sqrt{52}$

$= 7.2\text{ cm}$

$\therefore$ Height $= 2x + 2 \times$ radius

$= 14.4 + 28$

$= 42.4\text{ cm}$

(14) $\text{Arc} = \frac{x}{360}\pi D$

$31.5 = \frac{x}{360}\pi(12.8)$

$31.5 \times 360 = x(12.8\pi)$

$x = \frac{11340}{12.8\pi}$

$= 282°$

(15) a) $h = 40 + 23\cos 60°$

$= 51.5\text{m}$

b) Minimum when $x = 180°$

$\therefore h = 40 + 23\cos 180°$

$= 17\text{m}$

c) $h = 61$

$\therefore 23\cos x + 40 = 61$

$23\cos x = 21$

$\cos x = \frac{21}{23}$

~~S~~	A
T	C

$x = \cos^{-1}\left(\frac{21}{23}\right)$

$x = 24°, 336°$

360 − 24