SNo.	Working	Marks
1	$$P(X<4)=P(X>4)$$ $$a=b+c$$ $$a-b=c \quad \longrightarrow (1)$$ $$P(X\le 5)=2P(X>5)$$ $$a+b=2c \quad \longrightarrow (2)$$ Equation $(1)+(2)$ gives: $$2a=3c$$ $$a=1.5c \quad \longrightarrow (3)$$ Equation $(2)-(1)$ gives: $$2b=c$$ $$b=0.5c \quad \longrightarrow (4)$$ but, $$\sum_{all\ x} P(X=x)=1$$ $$a+b+c=1$$ $$1.5c+0.5c+c=1$$ $$3c=1$$ $$c=\frac{1}{3}$$ From equation (3), $$a=1.5\times\frac{1}{3}=\frac{1}{2}$$ From equation (4), $$b=0.5\times\frac{1}{3}=\frac{1}{6}$$	**B1-**eqn 1 **B1-**eqn 2 **M1-**solving to get a and b in terms of c **M1-**substitution and equating to 1 **A1-**all values of a, b and c correct
		05
2	For the first ball, $$u_1=0\text{ m s}^{-1},\qquad t_1=t,\qquad s_1=h$$ $$s_1=u_1t_1+\frac{1}{2}g{t_1}^2$$ $$h=0+\frac{1}{2}\times 9.8\times t^2$$ $$h=4.9t^2 \quad \longrightarrow (1)$$ For the second ball, $$u_2=14\text{ m s}^{-1},\qquad t_2=t-1,\qquad s_2=h$$ $$s_2=u_2t_2+\frac{1}{2}g{t_2}^2$$	**M1-**eqn for motion of the first ball

	$$h = 14 \times (t-1) + \frac{1}{2} \times 9.8 \times (t-1)^2$$ $$4.9t^2 = 14t - 14 + 4.9 \times (t^2 - 2t + 1)$$ $$4.9t^2 = 14t - 14 + 4.9t^2 - 9.8t + 4.9$$ $$0 = 4.2t - 9.1$$ $$t = \frac{13}{6} \approx 2.1667 \text{ s}$$ From equation (1), $$h = 4.9 \times \left(\frac{13}{6}\right)^2 = \frac{8281}{360} \approx 23.0028 \text{ m}$$	**M1-**eqn for motion of the 2nd ball and subs. For h **A1-**value of t **M1 A1-** substitution and output
		05
3	$$h = \frac{\frac{\pi}{2} - 0}{5 - 1} = \frac{\pi}{8}$$	**B1-**value of h
	(table below)	**B1-**values of x_n **B1-**values of y_n
	$$\int_0^{\frac{\pi}{2}} x \sin x \, dx \approx \frac{1}{2} h[(y_0 + y_4) + 2(y_1 + \cdots + y_3)]$$ $$\approx \frac{1}{2} \times \frac{\pi}{8} \times [1.570796 + 2 \times 1.794059] \approx 1.012950$$ $$\approx 1.0130 \text{ (4 d.p)}$$	**M1-**substitution **A1-**output to 4 d.p
		05
4		

n	x_n	y_0, y_5	$y_1, \dots y_4$
0	0	0.000000	
1	$\frac{\pi}{8}$		0.150279
2	$\frac{2\pi}{8}$		0.555360
3	$\frac{3\pi}{8}$		1.088420
4	$\frac{\pi}{2}$	1.570796	
sums		1.570796	1.794059

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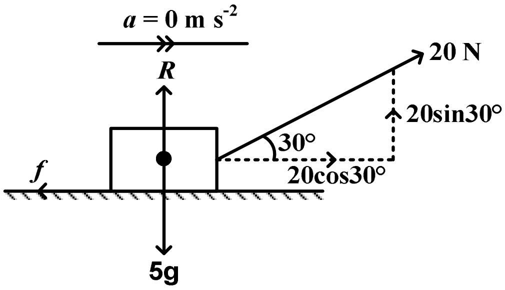

Resolving horizontally,

$$20\cos 30° - f = ma$$
$$10\sqrt{3} - f = 0$$
$$f = 10\sqrt{3} \approx 17.3205 \text{ N}$$

The friction force is 17.3205 N.
Resolving vertically,

$$R + 20\sin 30° = 5g$$
$$R + 10 = 5 \times 9.8$$
$$R = 39 \text{ N}$$

The normal reaction is 39 N.
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B1-force diagram

M1-resolving

A1-value of f

M1-resolving and subs. For g
A1-value of R
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05
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(i).

X	10.1	x_1	10.34
Y	0.8008	0.99	1.3003

$$\frac{x_1 - 10.1}{10.34 - 10.1} = \frac{0.99 - 0.8008}{1.3003 - 0.8008}$$
$$\frac{x_1 - 10.1}{0.24} = \frac{0.1892}{0.4995}$$
$$x_1 = 10.1 + \frac{0.1892}{0.4995} \times 0.24 = 10.1909$$

(ii).

X	9.9	10	10.1
Y	y_1	0.6484	0.8008

$$\frac{y_1 - 0.6484}{0.8008 - 0.6484} = \frac{9.9 - 10}{10.1 - 10}$$
$$\frac{y_1 - 0.6484}{0.1524} = \frac{-0.1}{0.1}$$
$$y_1 = 0.6484 - 1 \times 0.1524 = 0.496$$
</td><td>

B1-extracting necessary values

M1-equation quotients

A1-output

M1-equating quotients

A1-output
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05
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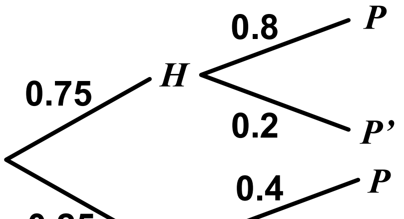
$$\underset{\sim}{\boldsymbol{F}_1} + \underset{\sim}{\boldsymbol{F}_2} + \underset{\sim}{\boldsymbol{F}_3} = m\underset{\sim}{\boldsymbol{a}}$$
</td><td></td></tr>
</table>

	$\binom{9}{3}+\binom{7}{3}+\binom{a}{b}=\frac{2000}{1000}\binom{10}{2}$ $\binom{16}{6}+\binom{a}{b}=\binom{20}{4}$ $\binom{a}{b}=\binom{20}{4}-\binom{16}{6}$ $\binom{a}{b}=\binom{4}{-2}$ $\therefore a=4,\quad$ and, $\quad b=-2$	**M1 M1 M1-**LHS, RHS, equating **B1-**simpplified output **B1-**stating both a and b.
		05
7	(i). $E(X)=np$ $2=n\times\frac{1}{20}$ $n=40$ (ii). Standard deviation $=\sqrt{npq}$ $=\sqrt{40\times\frac{1}{20}\times\left(1-\frac{1}{20}\right)}=\frac{\sqrt{190}}{10}\approx 1.3784$	**M1-**substitution **A1-**value of n **M1 M1 A1-** variance, square root, output
		05
8	Let H denote doing homework and P denotes passing the examination.  (a). $P(H'\cap P)=0.25\times 0.4=0.1$ (b). $P(P)=P(H\cap P)+P(H'\cap P)$ $=(0.75\times 0.8)+(0.25\times 0.4)=0.6+0.1=0.7$	**B1-**tree diagram **M1 A1-**subs. And output **M1 A1-** substitution and output
		05

9

Vaccines	f	x	fx	fx^2	c	f/c
0 – 100	80	50	4,000	200,000	100	0.8
100 – 200	250	150	37,500	5,625,000	100	2.5
200 – 300	500	250	125,000	31,250,000	100	5
300 – 500	800	400	320,000	128,000,000	200	4
500 – 550	100	525	52,500	27,562,500	50	2
550 – 600	40	575	23,000	13,225,000	50	0.8
600 – 650	25	625	15,625	9,765,625	50	0.5
650 – 800	15	725	10,875	7,884,375	150	0.1
800 – 850	10	825	8,250	6,806,250	50	0.2
Total	1,820		596,750	230,318,750		

B1- fx values and summation

B1- fx^2 values and summation

B1- f/c values

(a). (i).

$$\text{Mean,} \quad \overline{x} = \frac{\sum fx}{\sum f} = \frac{596{,}750}{1{,}820} = \frac{8525}{26} \approx 327.8846$$

M1 A1- substitutio and output

(ii).

$$\text{Variance} = \frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2$$

$$= \frac{230{,}318{,}750}{1{,}820} - \left(\frac{596{,}750}{1{,}820}\right)^2 = 19040.44273$$

M1 A1- substitution and output

ALT:

Let $d = \frac{x-525}{100}$

Vaccines	f	x	d	fd	fd^2	c	f/c
0 – 100	80	50	– 14.75	– 380	1805	100	0.8
100 – 200	250	150	– 3.75	– 937.5	3515.625	100	2.5
200 – 300	500	250	– 2.75	– 1375	3781.25	100	5
300 – 500	800	400	– 1.25	– 1000	1250	200	4
500 – 550	100	525	0	0	0	50	2
550 – 600	40	575	0.5	20	10	50	0.8
600 – 650	25	625	1	25	25	50	0.5
650 – 800	15	725	2	30	60	150	0.1
800 – 850	10	825	3	30	90	50	0.2
Total	1,820			– 3,587.5	10,536.875		

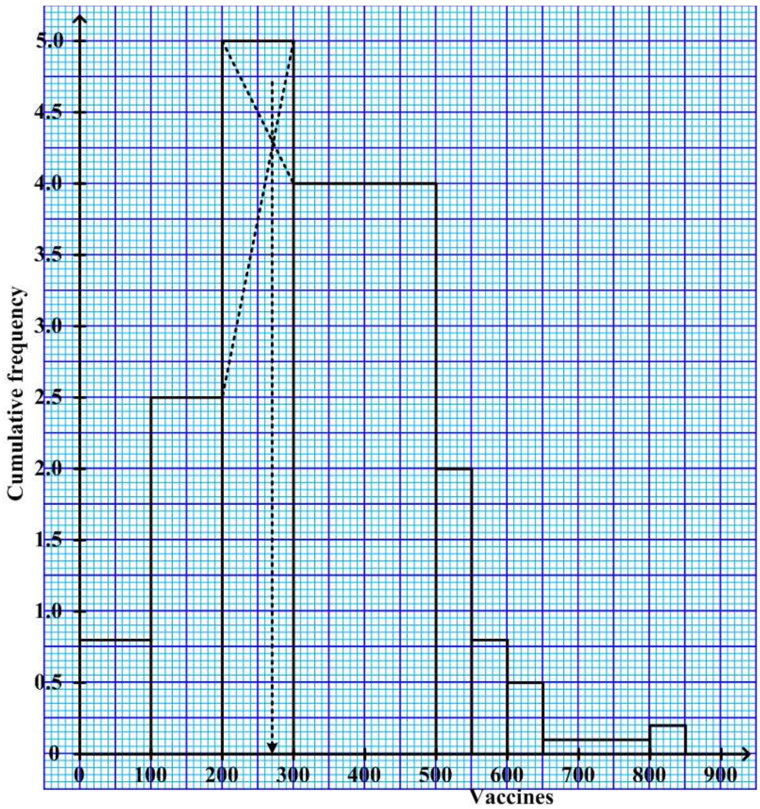
(a). (i).

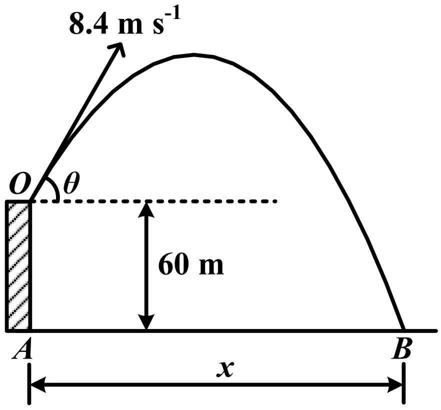
$$\text{Mean,} \quad \overline{x} = A + \frac{c\sum fd}{\sum f}$$

$$= 525 + \frac{100 \times (-3{,}587.5)}{1{,}820} = \frac{8525}{26} \approx 327.8846$$

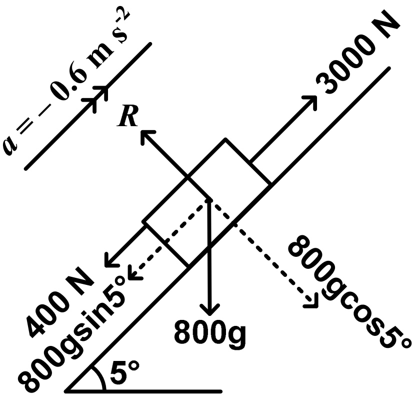
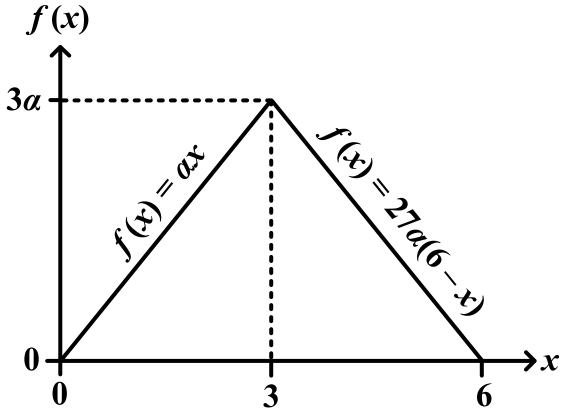
(ii).

$$\text{Variance} = c^2\left[\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2\right]$$

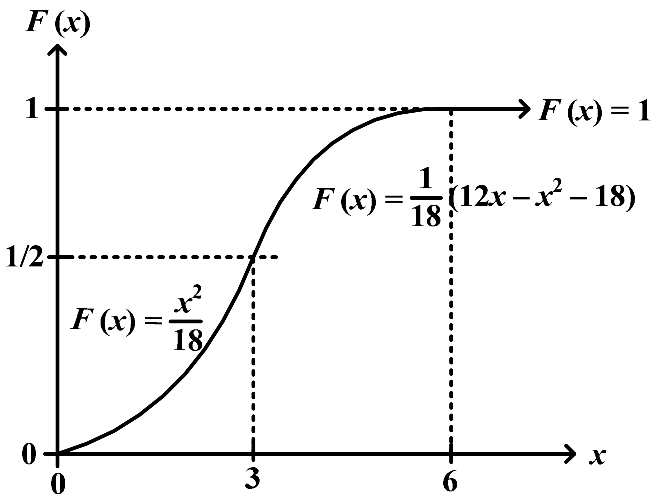
	$$= 100^2 \times \left[\frac{10{,}536.875}{1{,}820} - \left(\frac{-3{,}587.5}{1{,}820}\right)^2\right] = 19040.44273$$ (b).  From the histogram, mode is 360.	**B1-**axes **B1 B1-**bars **M1-**attempting to get mode **B1-**mode
		12
10	(a). $$y_{\text{max}} = \frac{(u \sin 30°)^2}{2g}$$ $$0.9 = \frac{u^2 \sin^2 30°}{2 \times 9.8}$$ $$0.9 = \frac{5u^2}{392}$$ $$u^2 = \frac{1764}{25}$$ $$u = \frac{42}{5} = 8.4 \text{ m s}^{-1}$$ (b).	**M1 M1-**substitution **M1 A1-**square root and output

	 (i). Considering vertical motion, $$y = ut\sin\theta - \frac{1}{2}gt^2$$ $$-60 = 8.4t\sin 30° - \frac{1}{2}\times 9.8t^2$$ $$-60 = 4.2t - 4.9t^2$$ $$4.9t^2 - 4.2t - 60 = 0$$ $$t = \frac{4.2 \pm \sqrt{(-4.2)^2 - 4\times 4.9\times(-60)}}{2\times 4.9}$$ $$t = \frac{3\pm\sqrt{609}}{7}$$ $$t = 3.9540, \quad \text{or,} \quad t = -3.0968$$ $$\text{but,} \quad t \neq -3.0968, \quad \Longrightarrow\ t = 3.9540\text{ s}$$ (ii). Considering horizontal motion, $$x = ut\cos\theta = 8.4\times 3.9540\cos 30° = 28.7638\text{ m}$$	**M1 M1-** substitution **M1-**quadratic eqn **M1-**solving **B1-**both values **B1-**conclusion **M1 A1-** substitution and output
		12
11	(a). $$f(x) = -\frac{\cos x}{x}$$ $$f(1) = -\frac{\cos 1}{1} = -0.5403$$ $$f(2) = -\frac{\cos 2}{2} = 0.2081$$ Since $f(1).f(2) < 0$, then a root exists between the x values of 1 and 2. (b). $$f(x) = \frac{-\cos x}{x}$$	**B1-** $f(1)$ **B1-** $f(2)$ **B1-**conclusion

	$$f'(x) = \frac{x \times \sin x - (-\cos x) \times 1}{x^2} = \frac{x \sin x + \cos x}{x^2}$$ $$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} \quad , \qquad n = 0, 1, 2, \ldots$$ $$x_{n+1} = x_n - \left(\frac{-\cos x_n}{x_n} \div \frac{x_n \sin x_n + \cos x_n}{{x_n}^2}\right)$$ $$x_{n+1} = x_n + \left(\frac{x_n \cos x_n}{x_n \sin x_n + \cos x_n}\right)$$ <table><tr><td>x</td><td>1</td><td>x_0</td><td>2</td></tr><tr><td>$f(x)$</td><td>– 0.5403</td><td>0</td><td>0.208 3</td></tr></table> $$\frac{x_0 - 1}{2 - 1} = \frac{0 + 0.5403}{0.2083 + 05403}$$ $$\frac{x_0 - 1}{1} = \frac{0.5403}{0.7486}$$ $$x_0 = 1 + \frac{0.5403}{0.7486} \times 1 = 1.7217$$ $$x_1 = 1.7217 + \left(\frac{1.7217 \cos 1.7217}{1.7217 \sin 1.7217 + \cos 1.7217}\right) = 1.55491$$ $$x_2 = 1.55491 + \left(\frac{1.55491 \cos 1.55491}{1.55491 \sin 1.55491 + \cos 1.55491}\right) = 1.57064$$ $$x_3 = 1.57064 + \left(\frac{1.57064 \cos 1.57064}{1.57064 \sin 1.57064 + \cos 1.57064}\right) = 1.57080$$ $$\therefore \text{Root} = 1.571 \text{ (3 d.p)}$$	**M1-**derivative **M1-**substitution **B1-**initial approximate root **M1 B1-**substitution and output **M1 B1-**substitution and output **M1-**substitution and output **A1-**root to 3 d.p
		12
12	(a). $$v = 43.2 \text{ km h}^{-1} = \frac{43.2 \times 1000}{3600} = 12 \text{ m s}^{-1}$$ Foward force, $\quad F = \frac{P}{v} = \frac{36 \times 1000}{12} = 3000 \text{ N}$ By Newton's second law: $$F - 400 = ma$$ $$3000 - 400 = 800 \times a$$ $$2600 = 800 \times a$$ $$a = 3.25 \text{ m s}^{-2}$$ (b). (i).	**B1-**velocity in m s^{-1} **M1 B1-**tractive force **M1 M1-**LHS, RHS **A1-**acceleration

	 Resolving parallel to the plane gives, $$3000-(400+800g\sin 5^\circ)=800a$$ $$3000-(400+800\times 9.8\sin 5^\circ)=800a$$ $$1916.6990=800a$$ $$a=2.3959\ \text{m s}^{-2}$$ (ii). $$\text{P.E}=mgh=800\times 9.8\times 120\sin 5^\circ=81996.12278\ \text{J}$$ **Note:** Part (b) is not so clear since initial velocity up the incline was not given.	**B1-**force diagram **M1 M1-**LHS, RHS **A1-**acceleration **M1 A1-**substitution and output
		12
13	(a). $$f(0)=\alpha\times 0=0,\qquad f(3)=3\alpha$$ $$f(3)=\frac{\beta}{9}\times 3=\frac{\beta}{3},\qquad f(3)=\frac{\beta}{9}\times 0=0$$ $$\text{but,}\qquad \frac{\beta}{3}=3\alpha,\qquad \Rightarrow \beta=9\alpha$$  $$\text{Total area}=1$$ $$\frac{1}{2}\times 6\times 3\alpha=1$$	**B1-**relation between β and α **B1-**graph **M1-**area and equating to 1

	$$9\alpha = 1$$ $$\alpha = \frac{1}{9}$$ $$\Rightarrow \beta = 9 \times \frac{1}{9} = 1$$ $$\therefore f(x) = \begin{cases} \frac{1}{9}x & ; \quad 0 \le x \le 3 \\ \frac{1}{9}(6-x) & ; \quad 3 \le x \le 6 \\ 0 & ; \quad \text{otherwise} \end{cases}$$	**B1-**value of α **B1-**value of β
	ALT: $$\int_{all\ x} f(x)\,dx = 1$$ $$\int_0^3 \alpha x\,dx + \int_3^6 \frac{\beta}{9}(6-x)\,dx = 1$$ $$\alpha\left[\frac{1}{2}x^2\right]_0^3 + \frac{9\alpha}{9}\left[6x - \frac{1}{2}x^2\right]_3^6 = 1$$ $$\alpha\left[\left(\frac{1}{2}\times 3^2\right) - 0\right] + \alpha\left[\left(6\times 6 - \frac{1}{2}\times 6^2\right) - \left(6\times 3 - \frac{1}{2}\times 3^2\right)\right] = 1$$ $$\alpha\left[\left(\frac{1}{2}\times 3^2\right) - 0\right] + \frac{9}{2}\alpha\left[18 - \left(18 - \frac{9}{2}\right)\right] = 1$$ $$\frac{9}{2}\alpha + \frac{9}{2}\alpha = 1$$ $$9\alpha = 1$$ $$\alpha = \frac{1}{9}$$ $$\Rightarrow \beta = 9 \times \frac{1}{9} = 1$$ $$\therefore f(x) = \begin{cases} \frac{1}{9}x & ; \quad 0 \le x \le 3 \\ \frac{1}{9}(6-x) & ; \quad 3 \le x \le 6 \\ 0 & ; \quad \text{otherwise} \end{cases}$$	**M1-**definition of total probability **M1-**integration and substituting limits **B1-**value of α **B1-**value of β
	(b). For $x \le 0$, $$f(t) = 0, \qquad \Rightarrow F(x) = 0$$ $$\therefore F(0) = 0$$ For $0 \le x \le 3$, $$f(t) = \frac{t}{9}\ , \qquad \Rightarrow F(x) = F(0) + \int_0^x \frac{t}{9}\,dt = 0 + \left[\frac{t^2}{18}\right]_0^x = \frac{x^2}{18}$$ $$\therefore F(3) = \frac{3^2}{18} = \frac{1}{2}$$ For $3 \le x \le 6$,	**M1-** $F(x)$ and $F(3)$ for $0 \le x \le 3$

	$f(t)=\frac{1}{9}(6-t)\ ,\qquad \Rightarrow F(x)=F(3)+\frac{1}{9}\int_3^x (6-t)\,dt$ $=\frac{1}{2}+\frac{1}{9}\left[6t-\frac{1}{2}t^2\right]_3^x$ $=\frac{1}{2}+\frac{1}{9}\left[\left(6x-\frac{1}{2}x^2\right)-\left(6\times 3-\frac{1}{2}\times 3^2\right)\right]$ $=\frac{1}{2}+\frac{1}{9}\left(6x-\frac{1}{2}x^2-\frac{27}{2}\right)=\frac{1}{2}+\frac{1}{9}\left(6x-\frac{1}{2}x^2-\frac{27}{2}\right)$ $=\frac{1}{18}(9+12x-x^2-27)=\frac{1}{18}(12x-x^2-18)$ $\therefore F(6)=\frac{1}{18}(12\times 6-6^2-18)=1$ For $x\geq 6$, $f(t)=0,\qquad \Rightarrow F(x)=F(6)=1$ $\therefore F(x)=\begin{cases} 0 & ; \quad x\leq 0 \\ \frac{1}{18}x^2 & ; \quad 0\leq x\leq 3 \\ \frac{1}{18}(12x-x^2-18) & ; \quad 3\leq x\leq 6 \\ 1 & ; \quad x\geq 6 \end{cases}$ **For the hence part:** $F(3)=\frac{1}{2}\ ,\qquad \Rightarrow \text{Median}=3$ (c).  	**M1-** $F(x)$ for $3\leq x\leq 6$ **B1-**$F(6)$ seen **B1-**stating $F(x)$ **B1-**stating median **B1-**axes and necessary coordinates **B1-**correct shape
		12
14	(a).	

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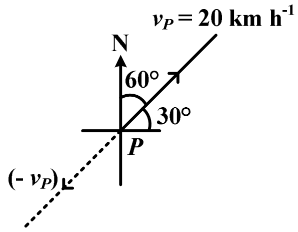

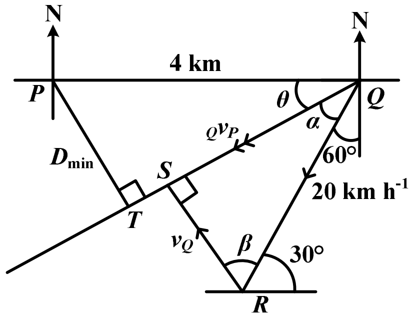

</td><td>B1-geometric diagram</td></tr>
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$$\cos\beta = \frac{v_Q}{20} = \frac{18}{20}, \qquad \Rightarrow \beta = 25.84°$$

</td><td>B1-value of β</td></tr>
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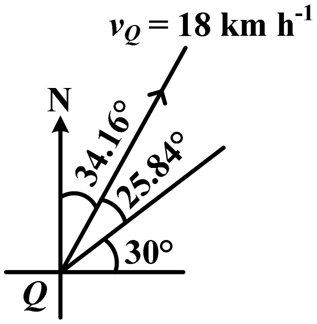

</td><td>B1-attempting to find course</td></tr>
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$\therefore$ Course set by $Q = 034.16°$

</td><td>B1-stating course in bearing form</td></tr>
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(b).
For triangle QRS,

$$\alpha = 90 - \beta = 90 - 25.84 = 64.16°$$
$$\theta = 90 - (60 + \alpha) = 90 - (60 + 25.84) = -34.16°$$

</td><td>B1-angle θ</td></tr>
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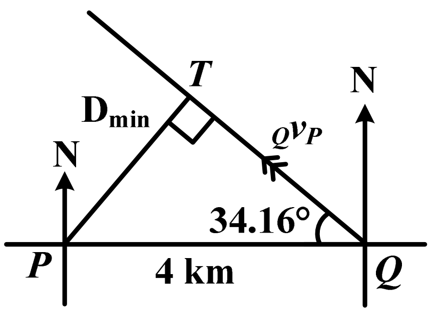

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Shortest distance, $D_{\min} = 4\sin 34.16° = 2.2460$ km
(c).

</td><td>M1 A1- substitution and output</td></tr>
</table>

	For triangle QRS, $${}_Qv_P = \sqrt{20^2 - 18^2} = 2\sqrt{19} \approx 8.7178 \text{ km h}^{-1}$$ Time for shortest distance, $$t = \frac{PS}{{}_Qv_P} = \frac{4\cos 34.16^\circ}{8.7178} = 0.3797 \text{ hours}$$ $$= 0.3797 \times 60$$ $$= 22.7802 \text{ minutes} \approx 23 \text{ minutes}$$ The two motor boats are closer to each other at 2:23 pm.	**M1 B1-** substitution and output **M1 B1-**division and output **B1-**time to nearest minute
		12
15	(a). $$\text{Error} = (x+\Delta x)^2 \sin(\theta + \Delta\theta) - x^2 \sin\theta$$ $$= [x^2 + 2x.\Delta x + (\Delta x)^2](\sin\theta\cos\Delta\theta + \cos\theta\sin\Delta\theta) - x^2\sin\theta$$ Assuming $(\Delta x) \ll x$, and that $(\Delta\theta)$ is a small angle measured in radians, $(\Delta x)^2 \approx 0$, $\sin\Delta\theta \approx \Delta\theta$ and $\cos\Delta\theta \approx 1$. $$\text{Error} = (x^2 + 2x.\Delta x)(\sin\theta + \Delta\theta.\cos\theta) - x^2\sin\theta$$ $$= x^2\sin\theta + x^2.\Delta\theta.\cos\theta + 2x.\Delta x.\sin\theta + 2x.\Delta x.\Delta\theta.\cos\theta - x^2\sin\theta$$ Assuming $(\Delta\theta) \ll \theta$, then $\Delta x.\Delta\theta \approx 0$. $$\therefore \text{Error} = x^2.\Delta\theta.\cos\theta + 2x.\Delta x.\sin\theta$$ $$\text{Absolute error} = \lvert x^2.\Delta\theta.\cos\theta + 2x.\Delta x.\sin\theta \rvert$$ $$\text{Relative error} = \left\lvert \frac{x^2.\Delta\theta.\cos\theta + 2x.\Delta x.\sin\theta}{x^2\sin\theta} \right\rvert$$ $$= \left\lvert \Delta\theta.\cot\theta + \frac{2\Delta x}{x} \right\rvert \le \lvert \Delta\theta.\cot\theta \rvert + \left\lvert \frac{2\Delta x}{x} \right\rvert$$ $$\therefore \text{Maximum relative error} = 2\left\lvert \frac{\Delta x}{x} \right\rvert + \lvert \Delta\theta.\cot\theta \rvert$$ **For the hence part:** $$x = 4.1, \quad \Longrightarrow \Delta a = 0.05$$ $$\theta = 30^\circ = \frac{30\pi}{180} = \frac{\pi}{6}, \quad \Longrightarrow \Delta\theta = 0.5^\circ = \frac{0.5\pi}{180} = \frac{\pi}{360}$$ $$\text{Percentage error} = \left(2\left\lvert \frac{\Delta x}{x} \right\rvert + \lvert \Delta\theta.\cot\theta \rvert\right) \times 100$$ $$= \left(2\left\lvert \frac{0.05}{4.1} \right\rvert + \left\lvert \frac{\pi}{360} \times \cot\frac{\pi}{6} \right\rvert\right) \times 100 = 3.9505\%$$ (b). $$\left(\frac{1}{x} - \frac{1}{y}\right)_{\max} = \frac{1}{x_{\min}} - \frac{1}{x_{\max}} = \frac{1}{(0.479 - 0.0005)} - \frac{1}{(3.1 + 0.05)}$$ $$= \frac{1}{0.4785} - \frac{1}{3.15} = 1.772403841 \approx 1.77240 \text{ (5 d. p)}$$ $$\left(\frac{1}{x} - \frac{1}{y}\right)_{\min} = \frac{1}{x_{\max}} - \frac{1}{x_{\min}} = \frac{1}{(0.479 + 0.0005)} - \frac{1}{(3.1 - 0.05)}$$	**M1-**definition of error **B1-**all assumptions correct **M1-**simplifying error **M1-**relative error **M1-**triangular inequality **B1-**max. R.E **M1 A1-** substitution and output **M1-**substitution **A1-**output-5 d.p **M1-**substitution

	$= \frac{1}{0.4795} - \frac{1}{3.05} = 1.757636883 \approx 1.75764 \text{ (5 d.p)}$	**A1-**output-5 d.p
		12
16	(a). Let B denote Bazooka, H denote Hybrid, L denote Longe H, T denote Traditional, and F denote flowering. $\text{Total ratio} = 4 + 3 + 2 + 1 = 10$ $P(F) = P(F \cap B) + P(F \cap H) + P(F \cap L) + P(F \cap T)$ $= P(B).P(F/B) + P(H).P(F/H) + P(L).P(F/L) + P(T).P(F/T)$ $= \left(\frac{4}{10} \times \frac{30}{180}\right) + \left(\frac{3}{10} \times \frac{70}{180}\right) + \left(\frac{2}{10} \times \frac{60}{180}\right) + \left(\frac{1}{10} \times \frac{50}{180}\right)$ $= \frac{1}{15} + \frac{7}{60} + \frac{1}{15} + \frac{1}{36} = \frac{5}{18}$ (b). Let $X\sim$ be the number of seeds that will flower. $n = 200, \quad p = \frac{5}{18}, \quad q = 1 - \frac{5}{18} = \frac{13}{18}$ $\mu = np = 200 \times \frac{5}{18} = \frac{500}{9} \approx 55.5556$ $\sigma = \sqrt{npq} = \sqrt{200 \times \frac{5}{18} \times \frac{13}{18}} = \sqrt{\frac{3250}{81}} \approx 6.3343$ $P(\text{less than 170 will flower}) = P(X < 170) \longrightarrow P(X < 170.5)$ $= P\left(Z < \frac{170.5 - 55.5556}{6.3343}\right) = P(Z < 18.1463) = 1$	**B1-**total ratio **M1 M1 M1 M1** **M1-**each bracket and addition **A1-**output **B1-**mean **B1-**variance **M1-**continuity correction **M1 A1-** standardising and probability
		12

END