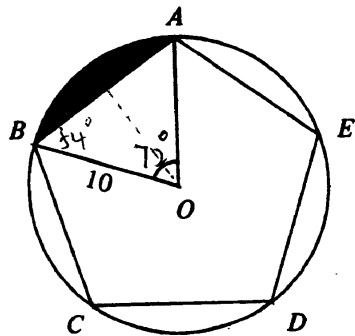


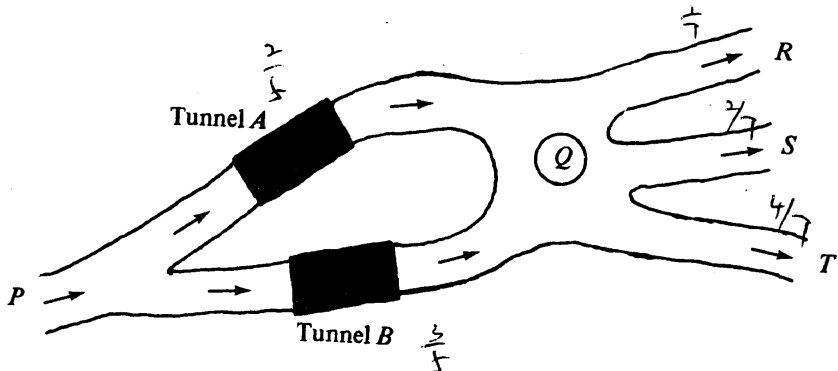
Solutions		Marks	Remarks
1. (a)	$\frac{\pi}{6}$ (radian) <i>(or 0.167π)</i>	1A	
(b)	$x = 150^\circ$ ($\frac{5\pi}{6}$, 2.62) <i>0.17 x</i>	1A	
(c)	cos A	<u>1A</u> 3	
2. (a)	$p + q$	1A	
(b)	-2	1A	
(c)	$\sqrt{3} - \sqrt{2}$ <i>(9A + 1/2)</i>	<u>1A</u> 3	
3. (a)	$y \geq \frac{1}{2}$	1A	} Withhold 1 mk if '=' omitted
	$2x - y \geq 2$	1A	
	$3x + 5y \leq 30$	1A	
(b)	16	<u>1A</u> 4	
4. (a) (i)	$x^2 - 2x = x(x - 2)$	1A	} $x^2 - 2x = 0$ $x(x-2) = 0$ <i>(6/2)</i>
(ii)	$x^2 - 6x + 8 = (x - 2)(x - 4)$	1A	
(b)	$\frac{1}{x^2 - 2x} + \frac{1}{x^2 - 6x + 8} = \frac{1}{x(x - 2)} + \frac{1}{(x - 2)(x - 4)}$		
	$= \frac{(x - 4) + x}{x(x - 2)(x - 4)}$	1M	
	$= \frac{2x - 4}{x(x - 2)(x - 4)}$	1A	<i>etc collect like terms</i>
	$= \frac{2}{x(x - 4)} \left(= \frac{2}{x^2 - 4x} \right)$	1A	
		<u>5</u>	
5. (a)	Slope of $L_2 = \frac{1}{2}$	1A	
	Slope of $L_1 = -2$		
	Equation of $L_1 : y - 5 = -2(x - 10)$	1M	} Pt-slope form
	i.e. $2x + y - 25 = 0$ <i>(or y = ...)</i>	1A	
(b)	Solving $\begin{cases} x - 2y + 5 = 0 \\ 4x + 2y - 50 = 0 \end{cases}$		
	$5x - 45 = 0$	1M	} Eliminating 1 unknown
	$x = 9$ (or $y = 7$)	1A	
	$\therefore L_1$ and L_2 meet at (9, 7)	<u>1A</u> 6	Accept $x = 9,$ $y = 7$

Solutions	Marks	Remarks
<p>6. For distinct real roots $\Delta = (2k)^2 - 4(k+6) > 0$</p> <p>$4k^2 - 4k - 24 > 0$</p> <p>$(k+2)(k-3) > 0$</p> <p>$\therefore k < -2 \text{ or } k > 3$</p>	<p>2M+1A</p> <p>1A</p> <p>2A</p> <hr style="width: 50%; margin-left: 0;"/> <p>6</p>	<p>1A for $(2k)^2 - 4(k+6)$ 2M for $\Delta > 0$ $(\Delta \geq 0, 1M \text{ only})$ For $(k+2)(k-3)$</p> <p>For ' ', ' = ' withhold 1 mk each</p>
<p>7. (a) $\angle AOB = \frac{360^\circ}{5} = 72^\circ \left(= \frac{2\pi}{5} \approx 1.26 \text{ radians} \right)$</p> <p>Area of $\triangle OAB = \frac{1}{2}(10)(10)\sin 72^\circ$</p> <p style="margin-left: 40px;">$= 47.6 \text{ (47.5528)}$</p>	<p>1A</p> <p>1M</p> <p>1A</p>	<p>Any figure roundable to 47.6</p>
<p>(b) Area of sector $OAB = \frac{1}{5} \cdot \pi 10^2$</p> <p style="margin-left: 40px;">$= 20\pi \text{ (62.83)}$</p> <p>Area of shaded part = $20\pi - 47.55$</p> <p style="margin-left: 40px;">$= 15.3 \text{ (15.2790)}$</p>	<p>1A</p> <p>1M</p> <p>1A</p> <hr style="width: 50%; margin-left: 0;"/> <p>6</p>	<p>Accept 15.2 ~ 15.3</p>
<p>8. (a) Total score of the team = $70(m+n)$</p> <p>(b) Total score is also equal to $75m + 62n$.</p> <p style="margin-left: 40px;">$75m + 62n = 70(m+n)$</p> <p style="margin-left: 40px;">$5m = 8n$</p> <p style="margin-left: 40px;">$m : n = 8 : 5 \left(= \frac{8}{5} \right)$</p> <p>(c) The number of men = $39 \times \frac{8}{8+5}$</p> <p style="margin-left: 40px;">$= 24$</p>	<p>1A</p> <p>1A</p> <p>1M</p> <p>1A</p> <p>1M</p> <hr style="width: 50%; margin-left: 0;"/> <p>1A</p> <hr style="width: 50%; margin-left: 0;"/> <p>6</p>	<p></p>



Solutions	Marks	Remarks																								
<p>9. (a) (i) Area of OAPB = $a \times b$</p> $= a(2a^2 - 4a + 3)$ $= 2a^3 - 4a^2 + 3a$	1A 1A																									
<p>(ii) For OAPB to be a square, $a = b$ or $OB = OA$</p> $a = 2a^2 - 4a + 3$ $2a^2 - 5a + 3 = 0$ $(2a - 3)(a - 1) = 0$ <p style="margin-left: 20px;"><i>Handwritten: 缺00等, 2a=3 or a=1, 2a=3</i></p> $\therefore a = \frac{3}{2} \text{ or } 1$	1M 1A <u>1A+1A</u> <u>6</u>	<p>Equating adjacent sides</p> <p style="margin-top: 100px;"><i>Handwritten: 要同时满足</i></p>																								
<p>(b) (i) If the area of OAPB = $\frac{3}{2}$,</p> $2a^3 - 4a^2 + 3a = \frac{3}{2}$ $\therefore 4a^3 - 8a^2 + 6a - 3 = 0 \dots \dots \dots (*)$	1A																									
<p>(ii) Let $f(a) = 4a^3 - 8a^2 + 6a - 3$</p> <p>$f(1.2) < 0$ ($= -0.408$) and $f(1.3) > 0$ ($= 0.068$)</p> <p>$\therefore (*)$ has a root lying between 1.2 and 1.3</p>	1A	<p><i>Handwritten: f(1.2) \cdot f(1.3) < 0</i></p> <p>Correct signs only</p>																								
<table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 30%;">Interval</th> <th style="width: 30%;">Mid-value a_i</th> <th style="width: 30%;">f(a_i)</th> </tr> </thead> <tbody> <tr> <td>$1.2 < a < 1.3$</td> <td>1.25</td> <td>- (-0.1875)</td> </tr> <tr> <td>$1.25 < a < 1.3$</td> <td>1.275</td> <td>- (-0.0643)</td> </tr> <tr> <td>$1.275 < a < 1.3$</td> <td>1.2875 <small>(1.288 etc)</small></td> <td>+ (+0.0007)</td> </tr> <tr> <td>$1.275 < a < 1.2875$</td> <td>1.28125</td> <td>- (-0.0321)</td> </tr> <tr> <td>$1.28125 < a < 1.2875$</td> <td>1.284375</td> <td>- (-0.01578)</td> </tr> <tr> <td>$1.284375 < a < 1.2875$</td> <td>1.2859375</td> <td>- (-0.00757)</td> </tr> <tr> <td>$1.2859375 < a < 1.2875$</td> <td></td> <td></td> </tr> </tbody> </table>	Interval	Mid-value a_i	f(a_i)	$1.2 < a < 1.3$	1.25	- (-0.1875)	$1.25 < a < 1.3$	1.275	- (-0.0643)	$1.275 < a < 1.3$	1.2875 <small>(1.288 etc)</small>	+ (+0.0007)	$1.275 < a < 1.2875$	1.28125	- (-0.0321)	$1.28125 < a < 1.2875$	1.284375	- (-0.01578)	$1.284375 < a < 1.2875$	1.2859375	- (-0.00757)	$1.2859375 < a < 1.2875$			1M+1A 1M	<p>1M for testing sign at mid-value</p> <p>Choosing correct interval</p>
Interval	Mid-value a_i	f(a_i)																								
$1.2 < a < 1.3$	1.25	- (-0.1875)																								
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$1.2859375 < a < 1.2875$																										
<p>$\therefore a = 1.29$ (corr. to 2 d.p.)</p>	<u>1A</u>	<p>Check last interval, $a \approx 1.2874$</p>																								
<div style="text-align: center;"> <p style="text-align: right;">$y = 2x^2 - 4x + 3$</p> </div>	<u>6</u>																									

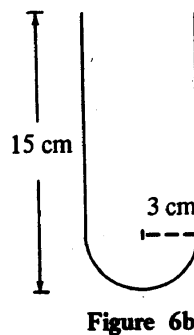
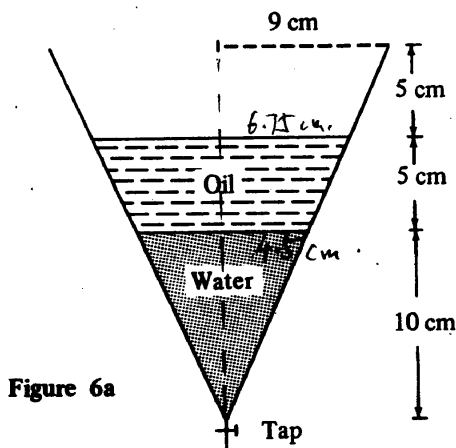
Solutions	Marks	Remarks
10. (a) The probabilities that a car leaving P will		
(i) pass through $B = 1 - \frac{2}{5} = \frac{3}{5}$ ($= 0.6$) (P_1)	1A	
(ii) not arrive at $T = 1 - \frac{4}{7} = \frac{3}{7}$ ($= 0.429$)	1A	$\frac{1}{7} + \frac{2}{7}$
(iii) arrive at R through Tunnel B $= \frac{3}{5} \times \frac{1}{7}$	1M	$P_1 \times \frac{1}{7}$
$= \frac{3}{35}$ ($= 0.0857$)	1A	$\frac{3}{35} < 1$
(iv) pass through Tunnel A but not arrive at R		
$= \frac{2}{5} \times (1 - \frac{1}{7})$	1A	$\frac{2}{5} \times \frac{2}{7} + \frac{2}{5} \times \frac{4}{7}$
$= \frac{12}{35}$ ($= 0.343$)	1A	
	<u>6</u>	
(b) (i) The probability that the first one will arrive at R and the second one at S		
$S = \frac{1}{7} \times \frac{2}{7} = \frac{2}{49}$ ($= 0.0408$) (P_2)	1A	Award 1A if $\frac{2}{49}$ given as answer
The probability that one of them will arrive at R and the other one at S		
$S = 2 \times \frac{1}{7} \times \frac{2}{7}$	1M	$P_2 \times 2$
$= \frac{4}{49}$ ($= 0.0816$)	1A	
(ii) The probability that both cars will arrive at S with the first one through Tunnel A and the second one through Tunnel B		
$= \frac{2}{5} \times \frac{2}{7} \times \frac{3}{5} \times \frac{2}{7} = \frac{24}{1225}$ (0.0196) (P_3)	1A	Award 1A if $\frac{24}{1225}$ given as answer
The required probability $= 2 \times \frac{24}{1225}$	1M	
$= \frac{48}{1225}$ (0.0392)	1A	$P_3 \times 2$
	<u>6</u>	



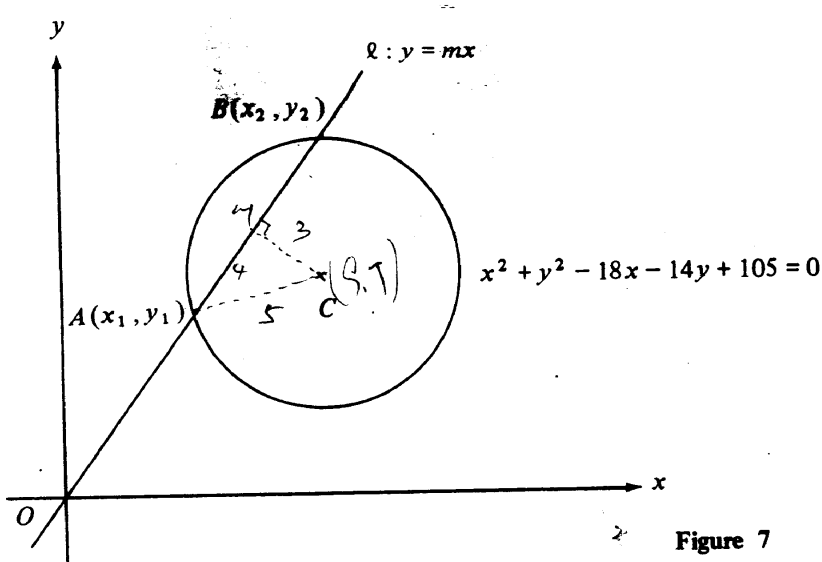
Solutions	Marks	Remarks
<p>11. (a) Proof :</p> <p>$\angle f_1 = \boxed{\angle a_1}$ ($\angle DAY$, etc.) (Corr. \angles, $AD \parallel FE$.)</p> <p>But $\boxed{\angle a_1 = \angle e_3}$ (Ext. \angle, cyclic quad.)</p> <p>$\therefore \angle f_1 = \angle e_3$</p> <p>$\therefore EY = \boxed{FY}$ (Sides opp. equal \angles)</p> <p>i.e. $\triangle EYF$ is isosceles</p>	<p>1A</p> <p>1A</p> <p>1A</p> <hr style="width: 50%; margin: 0 auto;"/> <p>3</p>	<p>Accept a_1, etc.</p> <p>统一答案 统一格式</p>
<p>(b) Proof :</p> <p>$\widehat{BCD} = \widehat{AFE}$ (Given)</p> <p>$\therefore \angle a_2 = \boxed{\angle d}$ (Equal arcs subtend equal \angles at circumference)</p> <p>$\therefore BA \parallel DE$ (Alt. \angles equal)</p>	<p>1A</p> <hr style="width: 50%; margin: 0 auto;"/> <p>1</p>	
<p>(c) Proof :</p> <p>$\angle a_1 = \boxed{\angle f_1}$ (Corr \angles, $AD \parallel FE$)</p> <p>But $\boxed{\angle f_1} = \angle b$ (Ext. \angle, cyclic quad.)</p> <p>and $\angle b = \angle e_1$ (Alt. \angles, $BA \parallel DE$)</p> <p>$\therefore \angle a_1 = \boxed{\angle e_1}$</p> <p>$\therefore A, X, E, Y$ are concyclic.</p> <p style="text-align: right;">(Ext. \angle equals int. opp. \angle)</p>	<p>1A</p> <p>1A</p> <p>1A</p> <hr style="width: 50%; margin: 0 auto;"/> <p>3</p>	
<p>(d) Solution :</p> <p>$\angle f_1 = 47^\circ$</p> <p>$\angle y = 86^\circ$</p> <p>$\angle x = 94^\circ$</p>	<p>1A</p> <p>1M+1A</p> <p>1M+1A</p> <hr style="width: 50%; margin: 0 auto;"/> <p>5</p>	<p>Note that</p> <p>$a_1 = a_2 = b = d = f_1$</p> <p>$= e_1 = e_3$</p> <p>$y = 180^\circ - f_1 - e_3$</p> <p>or $y = 180^\circ - x$</p> <p>$x = 180^\circ - y$</p> <p>or $x = b + a_2$</p> <p>or $x = e_1 + d$</p> <p>统一答案</p>

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Solutions	Marks	Remarks
12. (a) (i) Capacity of funnel = $\frac{1}{3} \pi (9)^2 \times 20$	1A	
= $540\pi \text{ cm}^3$	1A	
(ii) Vol. of water : total vol. of oil and water : cap of funnel		
= $10^3 : 15^3 : 20^3$	1A+1A	1A for 10:15:20
= $2^3 : 3^3 : 4^3 (= 8:27:64)$	1A	<i>By 10:15:20</i>
∴ vol. of water : vol. of oil : capacity of funnel		
= $8:19:64$	<u>1A</u>	
	<u>6</u>	
(b) Let the depth of water be h cm.		
Capacity of bottom part = $\frac{2}{3} \pi \cdot 3^3$	1A	
= $18\pi \text{ (cm}^3\text{)}$		
<i>67.5π</i> $540\pi \times \frac{8}{64} = \pi \times 3^2 (h - 3) + 18\pi$	1M	Equating vol. of water in two forms
∴ depth = $8\frac{1}{2}$ cm	<u>1A</u>	
	<u>3</u>	
(c) Vol. of water : vol. of oil = 8:19		
∴ depth of water : depth of oil = $2 : \sqrt[3]{19}$	2M	
∴ depth of oil = $10 \times \frac{\sqrt[3]{19}}{2} = 5\sqrt[3]{19} \text{ cm (13.3 cm)}$	<u>1A</u>	
	<u>3</u>	



Solutions	Marks	Remarks
13. (a) $C = (9, 7)$ (or $x = 9, y = 7$)	1A	8.7 (part)
Radius = $\sqrt{9^2 + 7^2} - 105 = 5$	$\frac{1A}{2}$	
(b) Putting $y = mx$,	1A	
$x^2 + (mx)^2 - 18x - 14(mx) + 105 = 0$		
$(1 + m^2)x^2 - (18 + 14m)x + 105 = 0$		
As x_1, x_2 are the roots, $x_1 x_2 = \frac{105}{1 + m^2}$	1A	Only awarded if above correct
	2	x_1, x_2 are the roots.
(c) $OA = \sqrt{x_1^2 + y_1^2}$	1A	(optional). 2 + 1
$= \sqrt{x_1^2 + (mx_1)^2}$	1A	
$= (\sqrt{1 + m^2})x_1$		
$OB = \sqrt{x_2^2 + y_2^2} = \sqrt{x_2^2 + (mx_2)^2} = (\sqrt{1 + m^2})x_2$	1A	
$\therefore OA \times OB = (1 + m^2)x_1 x_2$		
$= 105$	$\frac{1A}{4}$	
(d) Let $M =$ mid-point of AB . If $CM = 3$,	1M	(part of the question)
$AM = \sqrt{5^2 - 3^2} (= 4)$	1A	(part of the question)
$\therefore AB = 2 \times 4 = 8$		
Let $OA = x$, then		OR
$x(x + 8) = 105$	1M	} $OM = \sqrt{OC^2 - CM^2}$
$x^2 + 8x - 105 = 0$		} $= \sqrt{9^2 + 7^2 - 3^2}$ 1M
$(x - 7)(x + 15) = 0$		} $= 11$
$\therefore x = 7$ (as $x \neq -15$)	$\frac{1A}{4}$	} $\therefore OA = OM - AM$ $= 11 - 4 = 7$ 1A



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Solutions	Marks	Remarks
14. (a) The common ratio = $\frac{b}{a}$	1A	
The sum to n terms = $\frac{a^n [1 - (\frac{b}{a})^n]}{1 - \frac{b}{a}}$	1M	or $\frac{a^n - \frac{b}{a} (ab^{n-1})}{1 - \frac{b}{a}}$
$= \frac{a(a^n - b^n)}{a - b} (= \frac{a^{n+1} - ab^n}{a - b})$	<u>1A</u>	
	<u>3</u>	
(b) (i) The balance at the end of		
(1) the 1st year = $\$1.08P$	1A	$= (1 + 8\%)P$
(2) the 2nd year = $\$(1.08^2P + 1.1 \times 1.08P)$	1A+1A	$= 1.1664P + 1.188P = 2.3544P$
(3) the 3rd year = $\$(1.08^3P + 1.1 \times 1.08^2P + 1.1^2 \times 1.08P)$	1A	$= 3.849552P$
(ii) At the end of the n th year, the balance		
$= \$P[1.08^n + 1.08^{n-1} \times 1.1 + 1.08^{n-2} \times 1.1^2 + \dots + 1.08^2 \times 1.1^{n-2} + 1.08 \times 1.1^{n-1}]$		
$= \$P \frac{1.08(1.08^n - 1.1^n)}{1.08 - 1.1}$	2A	
$= \$54P(1.1^n - 1.08^n)$	<u>1</u>	
	<u>7</u>	
(c) In n years' time, the flat is worth $\$1080000 \times 1.15^n$	1A	
Put $P = 20000$, the amount in the man's account		
$= \$1080000(1.1^n - 1.08^n)$		
$< \$1080000 \times 1.15^n$	<u>1A</u>	
	<u>2</u>	
$P(1+8\%) = 1.08P$		
$(1.08P + 1.1P) \times (1 + 8\%)$ $= (1.08P + 1.1P) \times 1.08$ $= 1.08^2P + 1.1 \times 1.08 \times P$		(-13)

Solutions	Marks	Remarks
<p>(d) Let M be a point on BD such that (or mid-pt of BD, etc.) $1M$</p> <p>$AM \perp BD$. We have $DM = MB$ as $AB = AD$.</p> <p>Let N be the mid-point of AC .</p> <p>Then $MN \perp AC$ as $AM = MC$.</p> <p>Similarly $DN \perp AC$.</p> <p>Now $\sin \angle ADE = \frac{AN}{AD}$</p> <p>$\therefore AN = 3 \sin 36.7^\circ \text{ m } (= 1.7928)$</p> <p>$AM = \frac{1}{2} BD = \frac{3}{2} \sqrt{2} \text{ m}$</p> <p>$\sin \angle AMN = \frac{AN}{AM} = \frac{3 \sin 36.7^\circ}{\frac{3}{2} \sqrt{2}} (= 0.84515)$</p> <p>$\therefore \angle AMN = 57.69 (57.6885)$</p> <p>$\therefore \angle AMC = 2 \times 57.69 = 115^\circ (~116^\circ)$</p>	<p>1A</p> <p>1M</p> <p><u>1A</u></p> <p style="text-align: center;">4</p>	<p>Considering AM</p> <p>See also alt. solution</p> <p>$3 \sin 36.5^\circ$ $3 \sin 36.8^\circ$</p> <p>Attempt to find $\angle AMN$ or $\angle AMC$</p>
<p>Alternatively:</p> <p>Now $\sin \angle ADE = \frac{AN}{AD}$</p> <p>$\therefore AC = 2AN = 2 \times 3 \sin 36.7^\circ \text{ m } (= 3.5858)$</p> <p>$AM = \frac{1}{2} BD = \frac{3}{2} \sqrt{2} \text{ m}$</p> <p>By the cosine formula,</p> $\cos \angle AMC = \frac{(\frac{3}{2} \sqrt{2})^2 + (\frac{3}{2} \sqrt{2})^2 - (2 \times 3 \sin 36.7^\circ)^2}{2(\frac{3}{2} \sqrt{2})(\frac{3}{2} \sqrt{2})}$ <p style="text-align: center;">$= -0.4286$</p> <p>$\therefore \angle AMC = 115^\circ (~116^\circ)$</p>	<p>1A</p> <p>1M</p> <p>1A</p>	<p>Attempt to find $\angle AMC$</p>

1992

CE

Math.

1. (a) $\frac{\pi}{6}$ (radian)

(b) $x = 150^\circ$ ($\frac{5\pi}{6}$, 2.62)

(c) $\cos A$

2. (a) $p + q$

(b) -2

(c) $\sqrt{3} - \sqrt{2}$

3. (a) $y \geq \frac{1}{2}$

$$2x - y \geq 2$$

$$3x + 5y \leq 30$$

(b) 16

4. (a) (1) $x^2 - 2x = x(x-2)$

$$(11) x^2 - 6x + 8 = (x-2)(x-4)$$

$$(b) \frac{1}{x^2 - 2x} + \frac{1}{x^2 - 6x + 8} = \frac{1}{x(x-2)} + \frac{1}{(x-2)(x-4)}$$

$$= \frac{(x-4) + x}{x(x-2)(x-4)}$$

$$= \frac{2x-4}{x(x-2)(x-4)}$$

$$= \frac{2}{x(x-4)} \left(= \frac{2}{x^2 - 4x} \right)$$

9. (a) (1) Area of OAPB = $a \times b$

$$= a(2a^2 - 4a + 3)$$

$$= 2a^3 - 4a^2 + 3a$$

(11) For OAPB to be a square, $a = b$

$$a = 2a^2 - 4a + 3$$

$$2a^2 - 5a + 3 = 0$$

$$(2a-3)(a-1) = 0$$

$$\therefore a = \frac{3}{2} \text{ or } 1$$

(b) (1) If the area of OAPB = $\frac{3}{2}$,

$$2a^3 - 4a^2 + 3a = \frac{3}{2}$$

$$\therefore 4a^3 - 8a^2 + 6a - 3 = 0 \dots\dots\dots (**)$$

(11) Let $f(a) = 4a^3 - 8a^2 + 6a - 3$

$$f(1.2) < 0 \text{ (} = -0.408 \text{) and } f(1.3) > 0 \text{ (} = 0.068 \text{)}$$

$\therefore (*)$ has a root lying between 1.2 and 1.3

7. (a) $\angle AOB = \frac{360^\circ}{5} = 72^\circ$ ($= \frac{2\pi}{5} = 1.26$ radians)

$$\text{Area of } \triangle OAB = \frac{1}{2}(10)(10)\sin 72^\circ$$

$$= 47.6 \text{ (47.5528)}$$

(b) Area of sector OAB = $\frac{1}{5} \cdot \pi 10^2$

$$= 20\pi \text{ (62.83)}$$

$$\text{Area of shaded part} = 20\pi - 47.55$$

$$= 15.3 \text{ (15.2790)}$$

8. (a) Total score of the team = $70(m+n)$

(b) Total score is also equal to $75m + 62n$.

$$75m + 62n = 70(m+n)$$

$$5m = 8n$$

$$m : n = 8 : 5$$

(c) The number of men = $39 \times \frac{8}{8+5}$

$$= 24$$

5. (a) slope of $L_2 = \frac{1}{2}$

slope of $L_1 = -2$

Equation of $L_1 : y - 5 = -2(x - 10)$

$$1.e. 2x + y - 25 = 0$$

(b) Solving $\begin{cases} x - 2y + 5 = 0 \\ 4x + 2y - 50 = 0 \end{cases}$

$$5x - 45 = 0$$

$$x = 9 \text{ (or } y = 7)$$

$\therefore L_1$ and L_2 meet at (9, 7)

6. For distinct real roots

$$\Delta = (2k)^2 - 4(k+6) > 0$$

$$4k^2 - 4k - 24 > 0$$

$$(k+2)(k-3) > 0$$

$$\therefore k < -2 \text{ or } k > 3$$

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