SENIOR SECONDARY IMPROVEMENT PROGRAMME 2013

education

Department: Education
GAUTENG PROVINCE

UNITY IN DIVERSITY

GRADE 12

MATHEMATICS

LEARNER HOMEWORK SOLUTIONS

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LEARNER HOMEWORK SOLUTIONS

SOLUTIONS TO HOMEWORK: SESSION

16.1 TOPIC: DATA HANDLING

QUESTION 1

(a)

Class intervals (ages)	Frequency ✓	Cumulative frequency ✓
$16 \leq x < 20$	0	0
$20 \leq x < 24$	5	5
$24 \leq x < 28$	10	15
$28 \leq x < 32$	5	20
$32 \leq x < 36$	3	23

(2)

(b)

Class intervals (ages)	Frequency	Cumulative frequency	Graph points
$16 \leq x < 20$	0	0	$(20 ; 0)$
$20 \leq x < 24$	5	5	$(24 ; 5)$
$24 \leq x < 28$	10	15	$(28 ; 15)$
$28 \leq x < 32$	5	20	$(32 ; 20)$
$32 \leq x < 36$	3	23	$(36 ; 23)$

Ages of Uruguay players

(6)

(c)

Lower quartile $23 \times \frac{1}{4} = 5{,}75$ Therefore $Q_1 = 24$	✓
Median $23 \times \frac{1}{2} = 11.5$ Therefore Median = 26	✓
Upper quartile $23 \times \frac{3}{4} = 17.25$ Therefore $Q_3 = 30$	✓ (3)

[11]

QUESTION 2

(a)

Class intervals	Frequency (f)	Midpoint (m)	$f \times m$ ✓	$m - \bar{x}$ ✓	$(m - \bar{x})^2$ ✓	$f \times (m - \bar{x})^2$ ✓
$20 \le x < 24$	5	22	110	-5	25	125
$24 \le x < 28$	10	26	260	-1	1	10
$28 \le x < 32$	5	30	150	3	9	45
$32 \le x < 36$	3	34	102	7	49	147
			$\bar{x} = \dfrac{622}{23} = 27$ ✓			$\sum f \times (m - \bar{x})^2 = 327$

(5)

(b) $\mathrm{SD} = \sqrt{\dfrac{\sum f.(x - \bar{x})^2}{23}} = \sqrt{\dfrac{327}{23}} = 3{,}8$	✓✓ (2)

GAUTENG DEPARTMENT OF EDUCATION   SENIOR SECONDARY INTERVENTION PROGRAMME

MATHEMATICS   GRADE 12   SESSION 16   (LEARNER HOMEWORK SOLUTIONS)

(c) **CASIO fx-82ES PLUS:** MODE 2 : STAT 1 : 1 – VAR SHIFT SETUP 3: STAT 1: ON Enter the midpoints: 22= 26= 30= 34= Enter the frequencies: 5= 10= 5= 3= AC SHIFT 1 4: VAR 3 : $x\sigma n$ = The answer will read: 3,8 **SHARP DAL:** MODE 1= Enter data: 22 STO 3 M+ 26 STO 9 M+ 30 STO 8 M+ 34 STO 3 M+ RCL 6 to get 3,8	✓✓ (2)

[9]

QUESTION 3

One standard deviation interval:

$(\bar{x} - s \,;\, \bar{x} + s)$

$= (8850 - 2950 \,;\, 8850 + 2950)$

$= (5900 \,;\, 11800)$

Two standard deviation intervals:

$(\bar{x} - 2s \,;\, \bar{x} + 2s)$

$= (8850 - 2 \times 2950 \,;\, 8850 + 2 \times 2950)$

$= (2950 \,;\, 14750)$

Three standard deviation intervals:

$(\overline{x} - 3s \, ; \, \overline{x} + 3s)$

$= (8850 - 3 \times 2950 ; 8850 + 3 \times 2950)$

$= (0 ; 17700)$

2%	✓✓	(2)
16%	✓	(1)
No, since there are some employees (less than 2%) earn below R3000,00. These employees will not live an acceptable lifestyle economically. **OR** Yes, there is a fair distribution of salaries since the majority of the employees,i.e. 68% earn a salary between R5 900 and R11 800 per month. Some employees will have more responsibilities or work longer hours and thus must be compensated accordingly. Less than 2% earn below R3000,00.	✓	(1) **[4]**

QUESTION 4
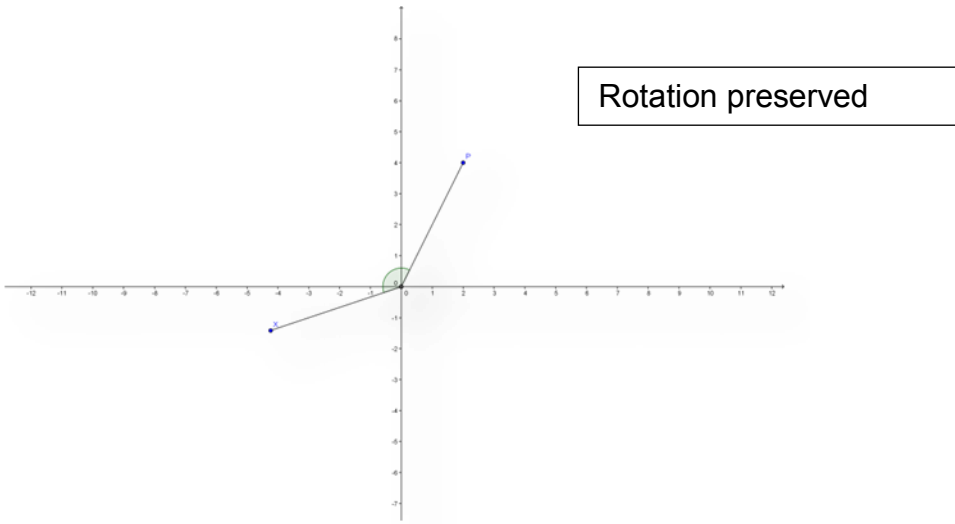
a.
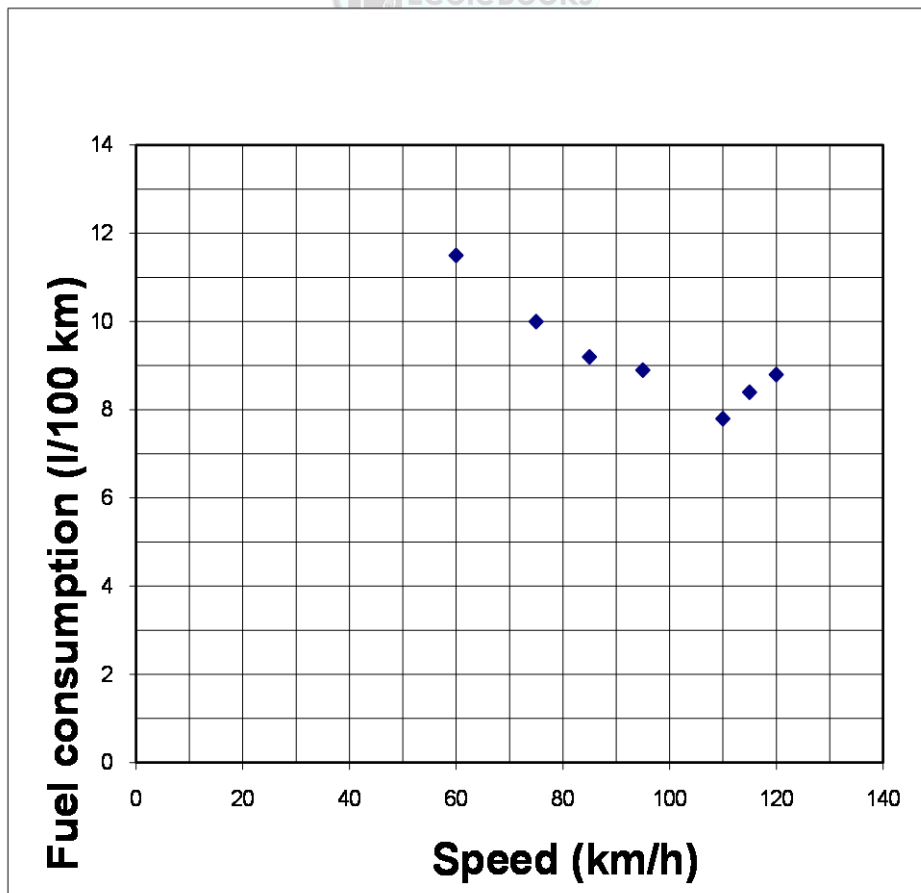
(3)

(b)	Quadratic	✓	(1)
(c)	Based on the quadratic trend the best fuel consumption occurs when the car is driven at 110 km/h. To keep its fuel bill to a minimum, drivers should drive at 110km/h	✓✓	(2)

[6]

SOLUTIONS TO HOMEWORK: SESSION 16.2 TOPIC : TRANSFORMATIONS

QUESTION 1

Rotation preserved

a)   OP=OX

$$(2 - 0)^2 + (4 - 0)^2 = \left(-3\sqrt{2} - 0\right)^2 + (y)^2$$

20=18 +y^2

∴ y^2 =2

∴ y=$\pm\sqrt{2}$ but y<0   ∴ y= - $\sqrt{2}$

X($-3\sqrt{2}$;- $\sqrt{2}$)

b)   x' = $x_A cos\theta$ - $y_A sin\theta$ and   y' = $y_A cos\theta$ + $x_A sin\theta$

$-3\sqrt{2}$ = 2cosθ - 4sinθ ……(1)   - $\sqrt{2}$ = 4cosθ + 2sinθ …….(2)

Multiply equation (1) by -2 and then add the equations

$$6\sqrt{2} = -4cos\theta + 8sin\theta$$
$$\underline{- \sqrt{2} = 4cos\theta + 2sin\theta}$$
$$5\sqrt{2} = 10sin\theta$$

$sin\theta = \frac{\sqrt{2}}{2}$

∴ θ = 45° but since θ is obtuse θ = 135°

QUESTION 2

2.1

$$(4)^2 + (3)^2 = r^2$$
$$\therefore r^2 = 25$$
$$\therefore r = 5$$

2.2

$$4\cos\theta - 3\sin\theta = \frac{4\sqrt{3}-3}{2}......A$$

$$3\cos\theta + 4\sin\theta = \frac{3\sqrt{3}+4}{2}.......B$$

$$16\cos\theta - 12\sin\theta = 2(4\sqrt{3}-3)......A\times 4$$

$$9\cos\theta + 12\sin\theta = \frac{3(3\sqrt{3}+4)}{2}.......B\times 3$$

$$\therefore 25\cos\theta = 2(4\sqrt{3}-3) + \frac{3(3\sqrt{3}+4)}{2}$$

$$\therefore 25\cos\theta = \frac{25\sqrt{3}}{2}$$

$$\therefore \cos\theta = \frac{\sqrt{3}}{2}$$

$$\therefore \theta = 30°$$

2.3

$$AB^2 = (5)^2 + (5)^2 - 2(5)(5)\cos 30°$$

$$\therefore AB^2 = 50 - 50\left(\frac{\sqrt{3}}{2}\right)$$

$$\therefore AB^2 = 50 - 25\sqrt{3}$$

$$\therefore AB^2 = 25(2-\sqrt{3})$$

$$\therefore AB = 5\sqrt{2-\sqrt{3}}$$

2.4

$$\text{Area } \Delta OAB = \frac{1}{2}(5)(5)\sin 30°$$

$$\therefore \text{Area } \Delta OAB = \frac{25}{4}\ units^2$$

QUESTION 3

3.1   X(-6; 0) Y(3, 6) and Z(6; -6)

3.2   Here you will use Analytical geometry to help work out the angles of inclination

Mxy = ⅔   and   MYZ = -4
Tanθ = ⅔   tanβ = -4
Θ = 33.69….   β = 104.03…..   ∴ α = 75.96…

∴ Ŷ = 180 – (75.96+33.69) = 70.4°

SOLUTIONS TO HOMEWORK:
SESSION 17.1 TOPIC : FUNCTIONS

QUESTION 1

$$f(x) = 2x$$
$$f\left(\frac{1}{x}\right) = 2\left(\frac{1}{x}\right)$$
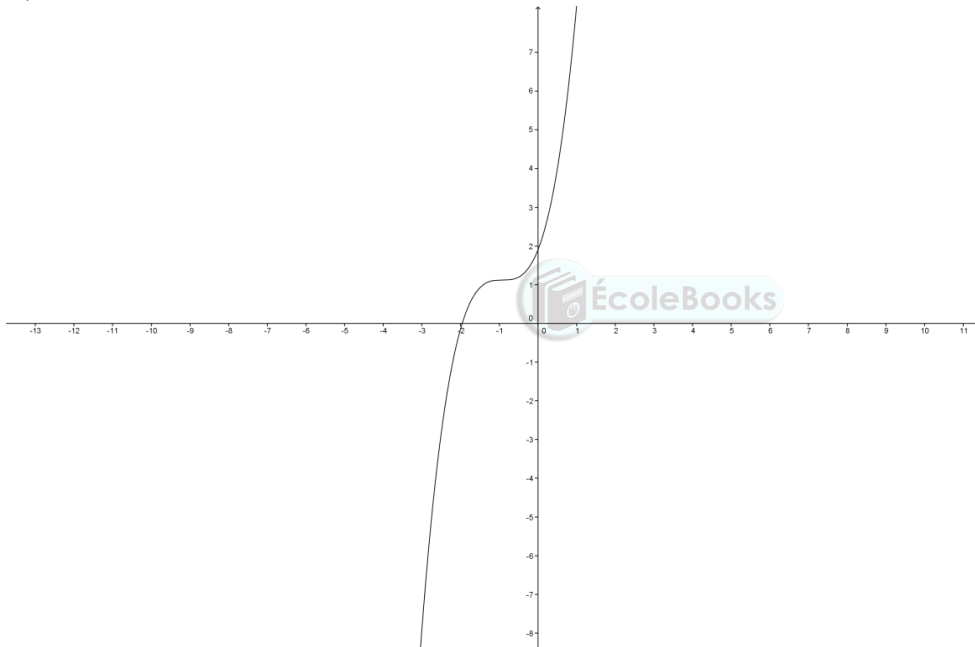$$\frac{1}{f(x)} = \frac{1}{2x}$$
$$f^{-1}(x) = \frac{1}{2}x \quad \text{y=2x swop x and y to find inverse: x = 2y so y =½x}$$
$$f(x) + f\left(\frac{1}{x}\right) + \frac{1}{f(x)} + f^{-1}(x) = 2x + \frac{2}{x} + \frac{1}{2x} + \frac{1}{2}x$$
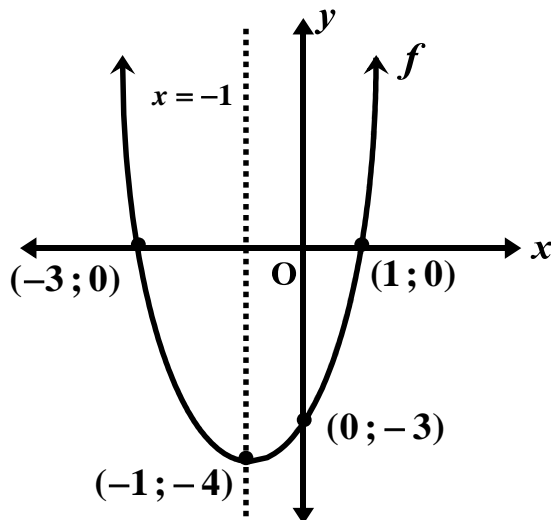$$= \frac{5x^2+5}{2x}$$

[6]

QUESTION 2

[5]

QUESTION 3

3.1

(6)

3.1.1 Range: $y \in [-4 \, ; \infty)$ (2)

[8]

QUESTION 4

4.1

$$y = a^x$$

$$\therefore \frac{1}{4} = a^2$$

$$\therefore a = \frac{1}{2}$$

(2)

4.2

$$y = \left(\frac{1}{2}\right)^x$$

$$\therefore x = \left(\frac{1}{2}\right)^y$$

$$\therefore y = \log_{\frac{1}{2}} x$$

(2)

4.3

$$y = \left(\frac{1}{2}\right)^x$$

(1)

4.4

$$y = 4x^2$$

$$\therefore x = 4y^2$$

$$\therefore \frac{x}{4} = y^2$$

$$\therefore y = \pm\sqrt{\frac{x}{4}}$$

(2)

4.5 $x > 0$ or $x < 0$ (2)

[9]

QUESTION 5

5.1 g(-½) = -1

$$\log_a \frac{1}{2} = -1$$

$$\therefore a^{-1} = \frac{1}{2}$$

$$\therefore a = 2$$

(2)

5.2 $x > 0$ and $x \neq 1$ (NB: The graph of g is only drawn for 0<x<1 but this is not the domain) (2)

5.3 $g^{-1}(x) = 2^x$

$x \in \mathbb{R}, x \neq 0$ (NB: From the log graph x≠ 1 so its' inverse will have y ≠ 1 the value that will make y=1 in $g^{-1}(x)$ is x=0 so it must be excluded from the domain.) (2)

[6]

SOLUTIONS TO HOMEWORK:
SESSION 17.2 TOPIC: CALCULUS

QUESTION 1

1.1.1	$P = 2h + 2r + \dfrac{1}{2} \times 2\pi r$ $\therefore P = 2h + 2r + \pi r$	✓ $2h + 2r$ ✓ πr (2)
1.1.2	$A = 2rh + \dfrac{1}{2}\pi r^2$	✓ $2rh$ ✓ $\dfrac{1}{2}\pi r^2$ (2)
1.2	$4 = 2rh + \dfrac{1}{2}\pi r^2$ $\therefore 8 = 4rh + \pi r^2$ $\therefore 8 - \pi r^2 = 4rh$ $\therefore \dfrac{8 - \pi r^2}{4r} = h$ $P = 2h + 2r + \pi r$ $\therefore P = 2\left(\dfrac{8 - \pi r^2}{4r}\right) + 2r + \pi r$ $\therefore P = \dfrac{8 - \pi r^2}{2r} + 2r + \pi r$ $\therefore P = \dfrac{4}{r} - \dfrac{\pi r}{2} + 2r + \pi r$ $\therefore P = \dfrac{4}{r} + \dfrac{\pi r}{2} + 2r$ $\therefore P = \dfrac{4}{r} + \left(\dfrac{\pi}{2} + 2\right)r$ $\therefore P = \left(\dfrac{\pi}{2} + 2\right)r + \dfrac{4}{r}$	✓ $4 = 2rh + \dfrac{1}{2}\pi r^2$ ✓ $\dfrac{8 - \pi r^2}{4r} = h$ ✓ $P = 2\left(\dfrac{8 - \pi r^2}{4r}\right) + 2r + \pi r$ ✓ $P = \left(\dfrac{\pi}{2} + 2\right)r + \dfrac{4}{r}$ (4)

1.3	$C = 10\left(\dfrac{\pi}{2}+2\right)r + \dfrac{40}{r}$	$\checkmark C = 10\left(\dfrac{\pi}{2}+2\right)r + \dfrac{40}{r}$
	$\therefore C = 5\pi r + 20r + 40r^{-1}$	$\checkmark C = 5\pi r + 20r + 40r^{-1}$
	$\therefore C'(r) = 5\pi + 20 - 40r^{-2}$	$\checkmark 0 = 5\pi + 20 - \dfrac{40}{r^2}$
	$\therefore C'(r) = 5\pi + 20 - \dfrac{40}{r^2}$	$\checkmark r = 1,06\text{m}$
	$\therefore 0 = 5\pi + 20 - \dfrac{40}{r^2}$	(4)
	$\therefore \dfrac{40}{r^2} = 5\pi + 20$	
	$\therefore \dfrac{40}{5\pi + 20} = r^2$	
	$\therefore \sqrt{\dfrac{40}{5\pi + 20}} = r$	
	$\therefore r = 1,06\text{m}$	**[12]**

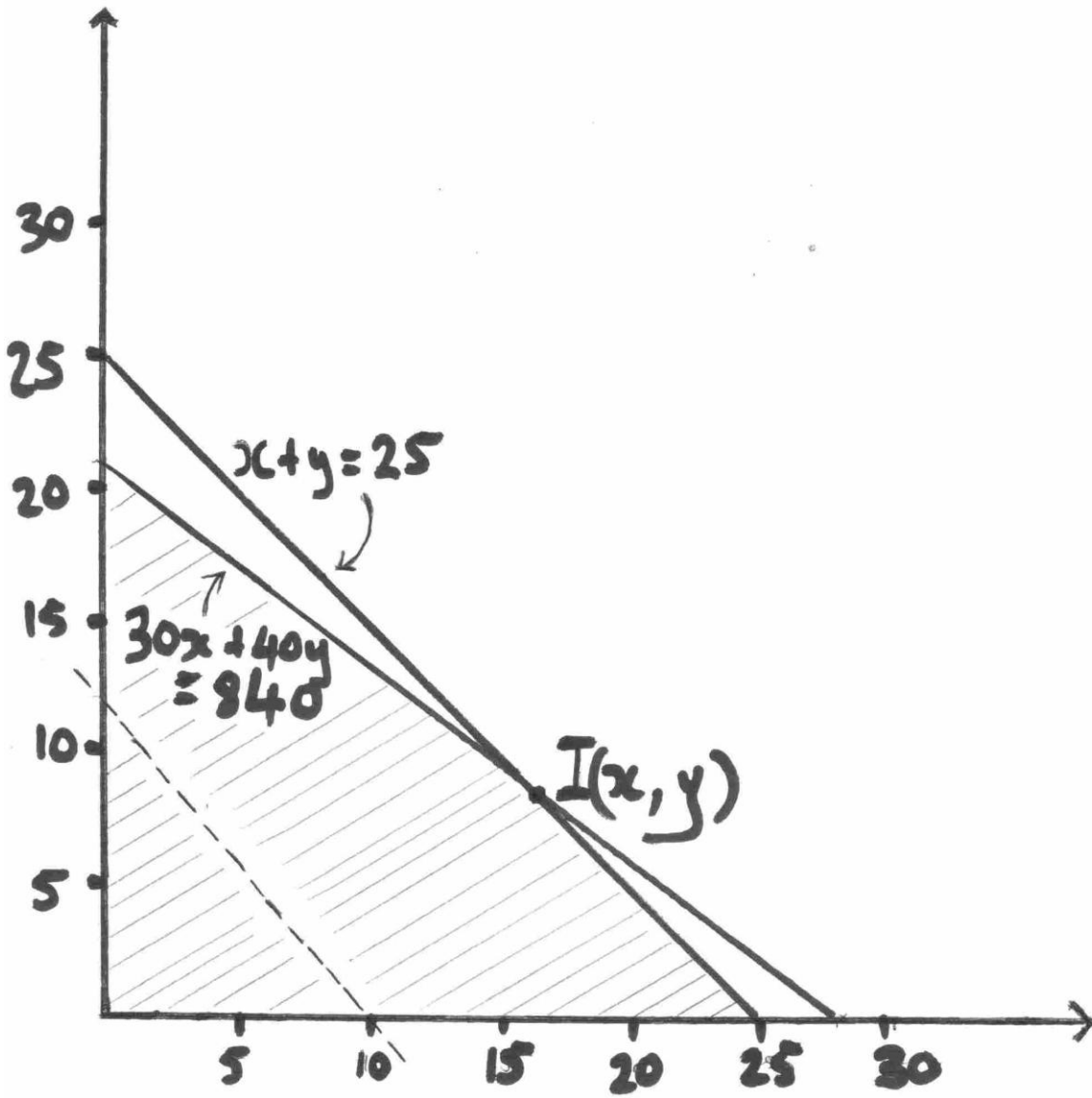**QUESTION 2**

2.1.	$At\ A\ and\ B: \ f'(x) = 0$ $f'(x) = 12x^2 + 54x - 30 = 0$ $2x^2 + 9x - 5 = 0$ $(2x - 1)(x + 5) = 0$ $x = \dfrac{1}{2}\ \ or\ \ x = -5$ $f\left(\dfrac{1}{2}\right) = 4\left(\dfrac{1}{2}\right)^3 + 27\left(\dfrac{1}{2}\right)^2 - 30\left(\dfrac{1}{2}\right) - 1$ $= \dfrac{-35}{4}\ (-8,75)$ $f(-5) = 4(-5)^3 + 27(-5)^2 - 30(-5) - 1$ $= 324$ $\therefore A(-5;324), \qquad B\left(\dfrac{1}{2}; \dfrac{-35}{4}\right)$	$\checkmark = 0$ $\checkmark$ substitution of x values $\checkmark\checkmark : 324)$ $\checkmark\checkmark \dfrac{-35}{4})$ (6)
2.2.	$Ave\ Grad = \dfrac{324 - \left(\dfrac{-35}{4}\right)}{-5 - \dfrac{1}{2}}$ $= \dfrac{-121}{2}\ \ (-60,5)$	$\checkmark$ subs x and y values $\checkmark$ $(-60,5)$ (2)
2.3.	$C(0; -1)$ $f'(0) = -30$ $Equ.\,of\,tangent: y = -30x - 1$	$\checkmark -1)$ $\checkmark = -30$ $\checkmark -30x - 1$ (3)

| 2.4. | $4x^3 + 27x^2 - 30x - 1 = -30x - 1$ $4x^3 + 27x^2 = 0$ $x^2(4x + 27) = 0$ $x = 0 \ \ or \ \ x = -\dfrac{27}{4}$ $\therefore x = \dfrac{-27}{4}$ | ✓cubic=tangent ✓$: + 27) = 0$ ✓$\dfrac{27}{4}$ (3) |

[14]

SOLUTIONS TO HOMEWORK: SESSION 18
TOPIC : LINEAR PROGRAMMING

QUESTION 1

1.1	$x + y \leq 25$ $30x + 40y \leq 840$ $x \leq 0$ $y \leq 0$ $x, y \ \in \mathbb{N}$	✓ $x + y \leq 25$ ✓ $30x + 40y \leq 840$ ✓ $x \leq 0$, $y \leq 0$, $x, y \ \in \mathbb{N}$ (3)
1.2	see diagram on next page	✓ $x + y \leq 25$ ✓ $30x + 40y \leq 840$ ✓ $x \leq 0$ ✓ $y \leq 0$ ✓ $x, y \ \in \mathbb{N}$ (5)
1.3	$10x + 12y = P$ $\therefore y = -1.2x + \dfrac{P}{12}$ Intersection $I(x, y)$ of $x + y = 25$ and $30x + 40y = 840$ $\therefore I(x, y) = (16, 9)$ Max at either $I(x, y)$ or $(25, 0)$ Max at $I(x, y), P = 268$ $\therefore x = 16, y = 9$	✓ $10x + 12y = P$ ✓ Intersection $I(x, y)$ of $x + y = 25$ and $30x + 40y = 840$ ✓ Check P at $I(x, y)$ and $(25, 0)$ ✓ Max at $I(x, y), P = 268$ (4)

[12]

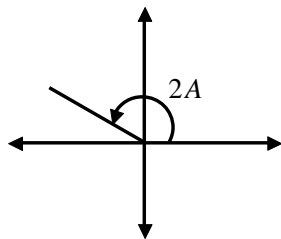| SOLUTIONS TO HOMEWORK: |
| SESSION 18.2 TOPIC : TRIGONOMETRY |

QUESTION 1

$$\frac{\sin(-145°).\cos(-215°)}{\sin 510°.\cos 340°}$$

$$= \frac{(-\sin 145°)(\cos 215°)}{(\sin 150°)(\cos 20°)}$$

$$= \frac{(-\sin 35°)(-\cos 35°)}{(\sin 30°)(\cos 20°)}$$

$$= \frac{\sin 35 \cos 35°°}{\left(\frac{1}{2}\right)(\cos 20°)}$$

$$= \frac{2\sin 35 \cos 35°°}{\cos 20°}$$

$$= \frac{\sin 70°}{\cos 20°}$$

$$= \frac{\cos 20°}{\cos 20°}$$

$$= 1$$

[8]

QUESTION 2

$$\sin 2A = \frac{\sqrt{5}}{3}$$

$$x^2 = r^2 - y^2$$

$$x^2 = 3^2 - \left(\sqrt{5}\right)^2$$

$$x^2 = 4$$

$$x = \pm 2$$

$$\therefore x = -2$$

$$\cos 2A = \frac{-2}{3}$$

[9]

QUESTION 3

$$\frac{\sin(90° + \theta) + \cos(180° + \theta)\sin(-\theta)}{\sin 180° - \tan 135°}$$

$$= \frac{\cos\theta + (-\cos\theta)(-\sin\theta)}{0 + 1}$$

$$= \cos\theta + \cos\theta.\sin\theta$$

$$= \cos\theta(1 + \sin\theta)$$

[5]

QUESTION 4

$$\frac{4\sin A\cos A\cos 2A.\sin 15°}{\sin 2A(1 - 2\sin^2 A)}$$

$$= \frac{4\sin A\cos A\cos 2A.\sin 15°}{2\sin A\cos A(1 - 2\sin^2 A)}$$

$$= \frac{2\cos 2A.\sin 15°}{\cos 2A}$$

$$= 2\sin 15°$$

$$= 2\sin(45° - 30°)$$

$$= 2[\sin 45°\cos 30° - \cos 45°\sin 30°]$$

$$= 2\left[\frac{\sqrt{2}}{2}.\frac{\sqrt{3}}{2} - \frac{\sqrt{2}}{2}.\frac{1}{2}\right]$$

$$= 2\left[\frac{\sqrt{6}}{4} - \frac{\sqrt{2}}{4}\right]$$

$$= \frac{\sqrt{6} - \sqrt{2}}{2}$$

[6]

QUESTION 5

$$6\cos x - 5 = \frac{4}{\cos x}$$

$$6\cos^2 x - 5\cos x = 4$$

$$6\cos^2 x - 5\cos x - 4 = 0$$

$$(3\cos x - 4)(2\cos x + 1) = 0$$

$$\cos x = \frac{4}{3} \quad or \quad \cos x = \frac{-1}{2}$$

$$\text{no solution} \quad or \quad x = 120° + k.360° , k \in Z$$

$$or$$

$$x = 240° + k.360° , k \in Z$$

Alternative solution for $\cos x = \frac{-1}{2}$

$$x = k.360° \pm 120° \quad k \in Z$$

[6]

> **Note:**
> If candidate puts $\pm k.360$ then $k \in N_0$

QUESTION 6

$$\cos^4 375° - \sin^4 345°$$

$$= \cos^4 15° - \sin^4 15°$$

$$= (\cos^2 15° + \sin^2 15°)(\cos^2 15° - \sin^2 15°)$$

$$= (1)(\cos 30°)$$

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

[6]

QUESTION 7

7.1

$$\sin 19° = \frac{t}{1}$$

$$x^2 + t^2 = 1^2$$

$$\therefore x^2 = 1 - t^2$$

$$\therefore x = \sqrt{1 - t^2}$$

$$\sin 79°$$

$$= \sin(19° + 60°)$$

$$= \sin 19° \cos 60° + \cos 19° \sin 60°$$

$$= (t)\left(\frac{1}{2}\right) + \left(\frac{\sqrt{1-t^2}}{1}\right)\left(\frac{\sqrt{3}}{2}\right)$$

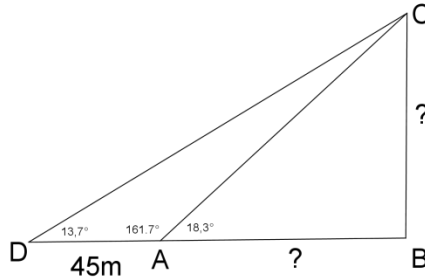$$= \frac{t + \sqrt{3}\sqrt{1-t^2}}{2} = \frac{t + \sqrt{3 - 3t^2}}{2}$$

(7)

7.2

$$\tan 71°$$

$$= \frac{\sin 71°}{\cos 71°}$$

$$= \frac{\cos 19°}{\sin 19°}$$

$$= \frac{\frac{\sqrt{1-t^2}}{1}}{t}$$

$$= \frac{\sqrt{1-t^2}}{t}$$

(3)

[10]

> **SOLUTIONS TO HOMEWORK:**
>
> **SESSION 19.1 TOPIC: 2D TRIGONOMETRY**

QUESTION 1

In ΔCDA $DAC = 180 - 18,3 = 161,7°$
                $DCA = 180 - (13,7 + 161,7) = 4,6°$

$$\frac{AC}{sin13,7} = \frac{45}{sin4,6}$$

$$\therefore AC = \frac{45 sin13,7}{sin4,6} = 133m$$

In ΔABC $sin18,3 = \frac{BC}{AC} = \frac{BC}{132,89}$
$\therefore BC = 132,89 \times sin18,3 = 42m$
Tree is 42m

Using Pythagoras: $AB = \sqrt{((132,89 ...)^2 - (41,7 ...))^2}$ = 126m = width of the river

QUESTION 2

2a)
$N\hat{D}B = 360° - 208° = 152°$

$\therefore M\hat{B}D = 28°$

$B\hat{D}A = 208° - 67° = 141°$

$\dfrac{sin\,D\hat{B}A}{97} = \dfrac{sin\,141°}{120}$

$\therefore sin\,D\hat{B}A = \dfrac{97\,sin\,141°}{120}$ $\therefore D\hat{B}A = 30,58°$

$\therefore sin\,D\hat{B}A = 0,5087006494$ $\therefore M\hat{B}A = 30,58° + 28°$

$\therefore M\hat{B}A = 58,58°$

SOLUTIONS TO HOMEWORK: SESSION 19.2 SELF

STUDY TOPIC: 3D TRIGONOMETRY

QUESTION 1

a)   In $\triangle ABC$
$$AC^2 = AB^2 + BC^2 - 2AB.BC\cos(90-\alpha)$$
$$= d^2 + \left(\frac{1}{2}d\right)^2 - 2d(\frac{1}{2}d)\sin\alpha$$
$$= \frac{5}{4}d^2 - d^2\sin\alpha = d^2\left(\frac{5}{4} - \sin\alpha\right)$$
$$\therefore AC = \frac{d\sqrt{(5-\sin\alpha)}}{2}$$

In $\triangle ACP$
$$\tan\theta = \frac{PC}{AC}$$
$$PC = h = AC\tan\theta = \frac{d\sqrt{(5-\sin\alpha)}}{2}\tan\theta$$

b) $$h = \frac{300\left(\sqrt{5-4\sin32}\right)}{2}\tan63 = 500m$$

QUESTION 2

a) $\angle BAC = 180 - (\theta+\beta)$

b) $$\frac{AB}{\sin\beta} = \frac{x}{\sin(180-(\theta+\beta))}$$
$$AB = \frac{x\sin\beta}{\sin(\theta+\beta)}$$

c   i)   IF AB = AC Then $\theta = \beta$
$$AB = \frac{x\sin\theta}{\sin2\theta} = \frac{x\sin\theta}{2\sin\theta\cos\theta} = \frac{x}{2\cos\theta}$$

ii)   In $\triangle BDA$
$$B = 90 - \theta$$
$$\frac{AB}{\sin\theta} = \frac{AD}{\sin(90-\theta)}   \therefore AD = \frac{\cos\theta(\frac{x}{2\cos\theta})}{\sin\theta} = \frac{x}{2\sin\theta}$$

QUESTION 3

a)

$$\frac{7}{\text{PB}} = \sin 18°$$

$$\therefore \text{PB} = \frac{7}{\sin 18°}$$

$$\therefore \text{PB} = 22{,}65247584..$$

b)

$$\frac{18}{\text{PA}} = \cos 23°$$

$$\therefore \text{PA} = \frac{18}{\cos 23°}$$

$$\therefore \text{PA} = 19{,}55448679....$$

c)

$$\text{AB}^2 = (22{,}65)^2 + (19{,}55)^2 - 2(22{,}65)(19{,}55).\cos 42°$$

$$\therefore \text{AB}^2 = 237{,}0847954...$$

$$\therefore \text{AB} = 15{,}40 \text{ m}$$

QUESTION 4

In $\triangle \text{AEB}$:

$$\text{EB}^2 = 8^2 + 6^2$$

$$\therefore \text{EB}^2 = 100$$

$$\therefore \text{EB} = 10$$

In $\triangle \text{GBC}$:

$$\text{BC}^2 = 15^2 + 8^2$$

$$\therefore \text{BC}^2 = 289$$

$$\therefore \text{BC} = 17$$

In $\triangle \text{ACB}$:

$$\text{EG}^2 = 15^2 + 6^2$$

$$\therefore \text{EG}^2 = 261$$

$$\therefore \text{EG} = \sqrt{261}$$

In $\triangle \text{EGB}$:

$$\therefore \left(\sqrt{261}\right)^2 = 17^2 + 10^2 - \left(2(17)(10)\cos E\hat{B}G\right)$$

$$\therefore 261 = 389 - \left(340\cos E\hat{B}G\right)$$

$$\therefore -128 = -340\cos E\hat{B}G$$

$$\therefore \frac{32}{85} = \cos E\hat{B}G$$

$$\therefore E\hat{B}G = 67{,}88°$$