Advanced Mathematics

General Instructions

- Working time – 120 minutes
- Write using black or blue pen.
- Approved calculators may be used.
- Marks may not be awarded for untidy or badly arranged work
- All answers should be given in simplest exact form unless specified otherwise
- If more space is required, clearly write the number of the QUESTION on the back page and answer it there. Indicate that you have done so
- Clearly indicate your class by placing an X, next to your class

NAME: _____

Examiner:

Total Marks – 118

- Attempt questions 1 – 7
- Each question has 5 multiple choice, followed by extended response.
- CIRCLE the correct answer for the multiple choice. (A), (B), (C) or (D)
- Extended response should include relevant mathematical reasoning and/or calculations.

Class	Teacher	
10 A	Mr Boros	
10 B	Ms Ward	
10 C	Ms Millar	
10 D	Ms Nesbitt/Ms Likourezos	
10 E	Mr Hespe	
10 F	Mr Elliott/Ms Chen	
10 G	Mr Gainford	

Question	Mark
1	/18
2	/18
3	/18
4	/18
5	/16
6	/15
7	/15
Total	/118

Section 1 (14 Marks)

1. Find the simple interest charged on $21 600 at 9% for 18 months. **(1m)**

2. Two dice are thrown. **(2m)**
   a) Draw a diagram or table showing the sample space.

   b) What is the probability of rolling a total of more than 5?

3. Find the volume of a sphere with radius 7cm. **(1m)**

4. Solve the following equations: (6m)

   a) $4x^2 - 12x - 7 = 0$
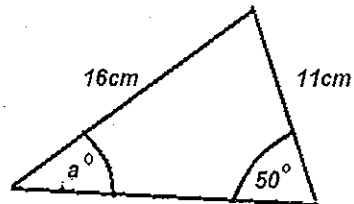
   b) $x^2 = 6x$

   c) $(x+1)^2 = 4x$

5. Simplify using index laws: (2m)

   $$\sqrt[3]{m^{-9}n^3}$$

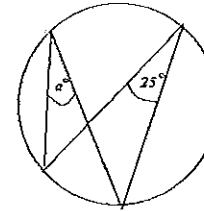6. Find the value of 'a' in the following triangle: (2m)
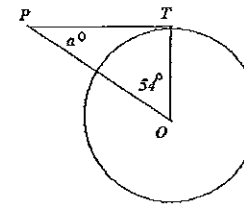

Section 2 (14 Marks)

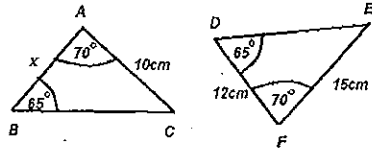1. Find the value of the variables. Give reasons. (2m)
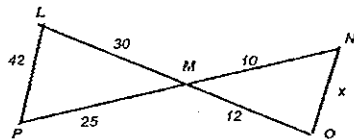
   a)

   b) PT is a tangent in the following diagram.

2. Phil invested $4700 at 8% p.a. compounding monthly for 3 years. Find the value of his investment after this time. (2m)
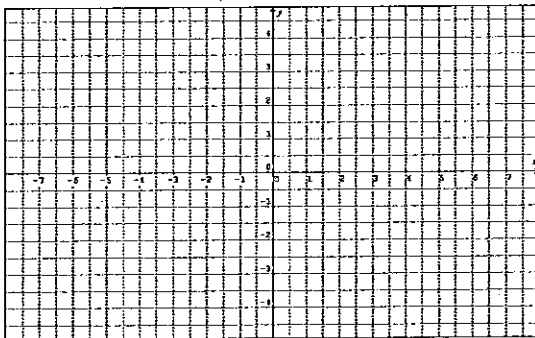
a) In the following questions, prove that the two triangles are similar and find the value of x (correct to one decimal place where necessary) **(5m)**

b)

3. Sketch the graph of $y = \frac{1}{2}(x+1)^2 - 2$ clearly showing the co-ordinates of the vertex and the X and Y intercepts. **(3m)**
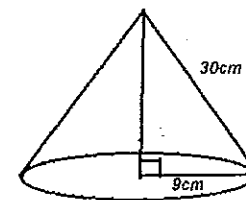

4. Solve by completing the square, giving the solution in simplest surd form:

$$x^2 - 15x + 56 = 0$$

(2m)
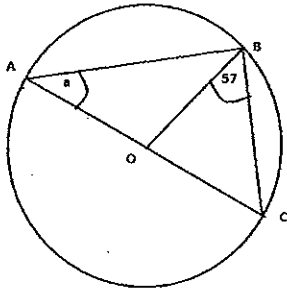
Section 3 (14 Marks)

5. Write a polynomial of degree 4 that is monic and has a constant term of 6.

(1m)

6. Find the remainder when $(x^5 - 2x^4 + x^3 + x - 3)$ is divided by $(x+4)$ **(2m)**

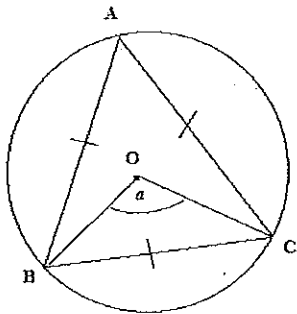7. Find the volume of this cone: **(2m)**

8. Find the value of the pronumeral, giving reasons in full. (The centre of the circle is labelled 'O'.)
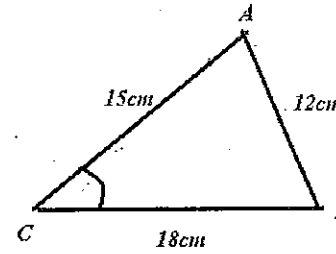
(2m)

9. Find the value of the pronumeral, giving reasons in full. (The centre of the circle is labelled 'O'.)

(2m)

10. Find the size of angle C :

(2m)

11. Solve this equation :

$$2^{2x+1} - 17(2^x) + 8 = 0$$

(3m)

Section 4 (14 Marks)

1. Solve this equation by using the quadratic formula, giving the solution in simplest surd form: $3x^2 + 2x - 2 = 0$ **(2m)**

2. Solve these equations simultaneously: **(3m)**
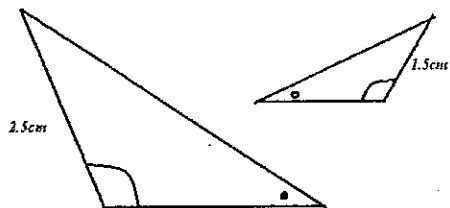
$$x^2 + y^2 = 169$$
$$x - y = -7$$

3. In a History test the mean was 61 and the standard deviation was 9. In a Science test the mean was 70 and the standard deviation 10. Elizabeth scored 75 in her history test and Jason scored 75 in his Science test. Who had the better score? Explain.   **(1m)**

4. How much must I invest now in order to have $10 000 at the end of 5 years, if interest is 3%p.a. compounding quarterly?   **(2m)**

5. Which rate will give the better return on an investment: 13% p.a. compounding annually or 12.5% p.a. compounding monthly? Show working.

            (2m)

6. For the following pair of similar triangles, state the ratio (in simplest form) of the area of the first triangle to the area of the second triangle. (2m)

2.5cm

1.5cm

7. The ratio of the heights of two similar gas cylinders is 2 : 3. If 4 kg of gas fills the smaller cylinder, how much gas is needed to fill the larger one?

(2m)

1. Solve the following equations: (4m)

   a) $x^6 - 28x^3 + 27 = 0$

   b) $(2x-5)^2 = 2x - 5$

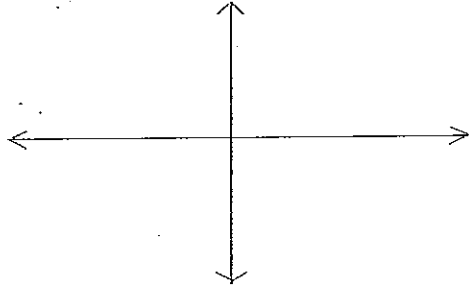2. Find the centre and radius of the circle
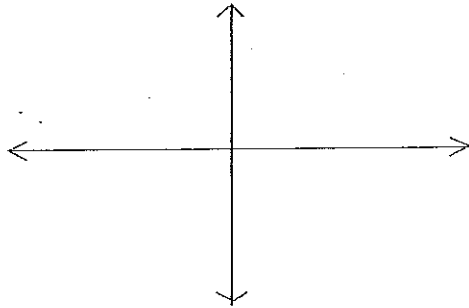
$$x^2 + y^2 - 16x - 2y + 56 = 0$$

(2m)

3. Sketch the following curves labelling all x and y intercepts:
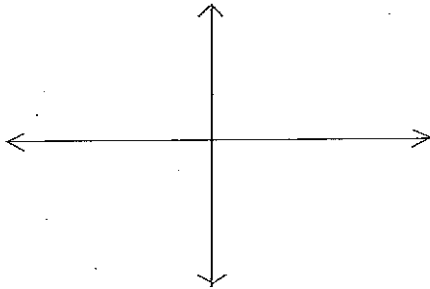
(6m)

a) $y = (x+3)(x-2)(x-5)$

b) $y = (x-3)^2(x+1)$

c) $y = x(x+2)^3$

4. Factorise fully: $P(x) = 2x^3 + 5x^2 - 4x - 12$

(3m)

Section 6 (14 Marks).

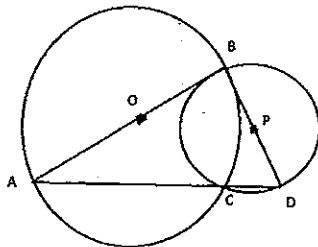1. Find k, given that $kx^3 + 4x^2 - 4$ is divisible by $x+2$. **(2m)**

2. When $Q(x) = ax^3 + bx^2 + 2x + 3$ is divided by $(x+1)$, the remainder is 3. When $Q(x)$ is divided by $(x-1)$ the remainder is 15. Find a and b. **(3m)**

3. Two circles intersect at B and C. AB and BD are diameters. Prove that A, C and D are collinear.

(3m)

4. The Department of Primary Industry is interested in the effect of a new fertilizer on the growth of maize plants. After 12 months growth, the heights (in cm) of the plants in 2 plots were measured and found to be as follows:

(3m)

Plot A (New fertilizer)

39	48	50	47	125	46	54	59	58	59
127	48	44	51	53					

Plot B (Original Fertilizer)

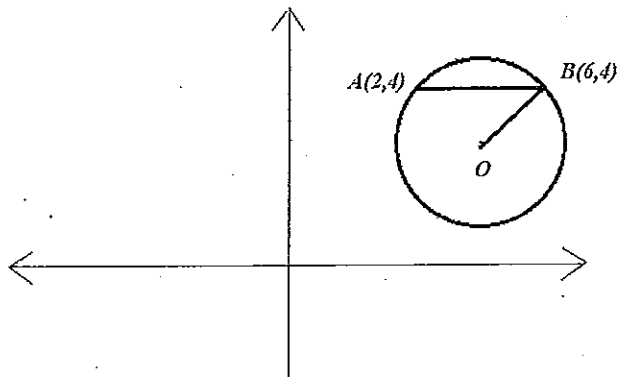| 65	55	59	60	63	57	58	61	62	60
59	63	60	61	57					

a) Calculate the mean and standard deviation of the two samples.

b) Using these results, compare the effectiveness of the different fertilizers on the growth of maize plants.

5. AB is a chord. Find the equation of the circle, given that $r = \sqrt{5}$.　　(3m)

Section 7 (15 Marks)

1. A ship leaves port and heads on a bearing of 145°T travelling at 17km/h. After 8 hours it alters course to a bearing of 253°T and continues at the same speed for another 12 hours. It then receives a report of a cyclone developing in the area. The ship increases speed to 21km/h and heads directly back to port.　　(5m)

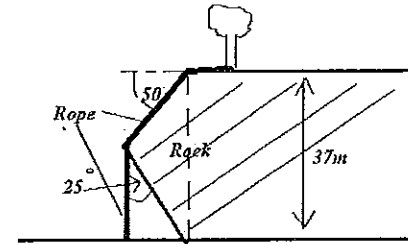   a) How long will it take to get back to port ?

   b) On what bearing (to the nearest minute) should it head?

2. Solve: $\sqrt{x+\sqrt{x}} + \sqrt{x-\sqrt{x}} = 3\sqrt{\dfrac{x}{x+\sqrt{x}}}$ (3m)

3. A cliff is 37m high. The rock slopes outward at an angle of 50° to the horizontal, then cuts back at an angle of 25° to the vertical, meeting the ground directly below the top of the cliff.

NOT TO SCALE

Carol wishes to absell from the top of the cliff to the ground as shown in the diagram. Her climbing rope is 45m long and she needs 2m to secure it to a tree at the top of the cliff. Will the rope be long enough to allow her to reach the ground?

(3m)

4. A boy plans a boating trip from his home on the edge of a lake to a town that lies on a river that empties into the lake. To make the trip, he travels 20km across the lake (in which there is no current) to the mouth of the river, and then rows a further 20km up the river against a current of 2km/hour. If the journey is completed in 15 hours, at what constant speed (relative to the water) does he travel?

(4m)

Section 1 (14 Marks)

1. Find the simple interest charged on $21 600 at 9% for 18 months. (1m)

$$I = PRT$$
$$= 21\,600 \times 0.09 \times 1.5$$
$$= \$2916$$

2. Two dice are thrown. (2m)

   a) Draw a diagram or table showing the sample space.

   b) What is the probability of rolling a total of more than 5?

$$1 - \frac{10}{36} = \frac{26}{36}$$
$$= \frac{13}{18}$$

3. Find the volume of a sphere with radius 7cm. (1m)

$$Vol = \frac{4}{3}\pi r^3$$
$$= \frac{1372\pi}{3}\ cm^3$$

or

$$\doteq 1436.76\ cm^3$$

4. Solve the following equations: (6m)

   a) $4x^2 - 12x - 7 = 0$

$$\frac{(4x - 14)(4x + 2)}{4} = 0 \qquad x = -\frac{1}{2},\ \frac{7}{2}.$$
$$(2x - 7)(2x + 1) = 0$$

   b) $x^2 = 6x$

$$x = 0,\ 6$$

   c) $(x+1)^2 = 4x$
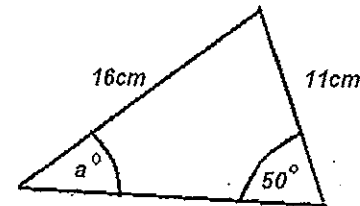
$$x^2 - 2x + 1 = 0$$
$$(x - 1)^2 = 0$$
$$x = 1,\ 1$$

5. Simplify using index laws: (2m)

$$\sqrt[3]{m^{-9}n^3} = \frac{n}{m^3}$$

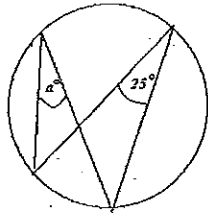6. Find the value of 'a' in the following triangle: (2m)

16cm   11cm   50°   a°

$$\frac{\sin a}{11} = \frac{\sin 50}{16}$$
$$a = 31°41'$$

Section 2 (14 Marks)
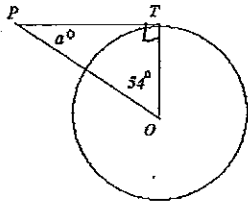
1. Find the value of the variables. Give reasons. (2m)

a)

$a = 25$ ✓②

angles at the circumference standing on the same arc are equal. ①/②

b) PT is a tangent in the following diagram.

$a + 90 + 54 = 180°$ angle sum of △ off radius and tangent line intersect at 90

$a = 36$ ①/②

2. Phil invested $4700 at 8% p.a. compounding monthly for 3 years. Find the value of his investment after this time. (2m)

compounding monthly $3 \times 12 = 36$ times

$r = \frac{8}{12}\% = \frac{2}{3}\%$ p month

$A = 4700\left(1 + \frac{\frac{2}{3}}{100}\right)^{36} = \$5970.11$ ②

a) In the following questions, prove that the two triangles are similar and find the value of x (correct to one decimal place where necessary) (5m)
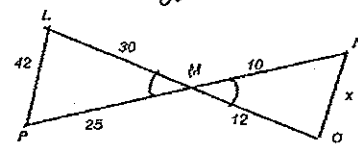

$\therefore \frac{10}{x} = \frac{15}{12}$

$15x = 120$ ①

$x = 8$
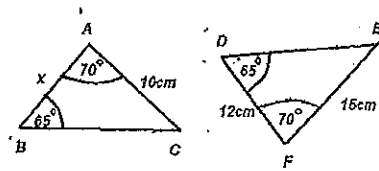
In △ABC and △FDE

$B\hat{A}C = D\hat{F}E = 70°$

$A\hat{B}C = F\hat{D}E = 65°$

$\therefore \triangle ABC \,|||\, \triangle FDE$ 2 angle test
①/② (equiangular)

b)

So

$\frac{30}{12} = \frac{42}{x}$

$x = 16.8$ ①
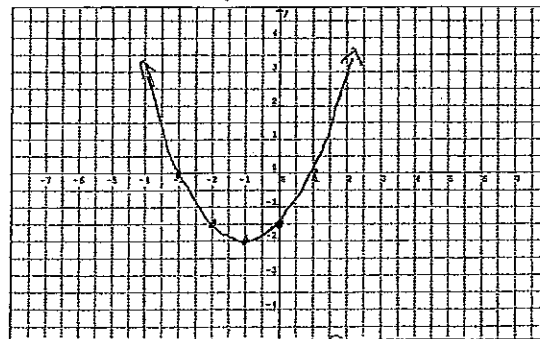
In △MLP and △MNO

$L\hat{M}P = N\hat{M}O$ (vertically opposite)

and $\frac{30}{12} = \frac{25}{10}$ ratio of sides are equal

$\therefore \triangle MLP \,|||\, \triangle MNO$ (ratio of sides and included angle test) ①/②

3. Sketch the graph of $y = \frac{1}{2}(x+1)^2 - 2$ clearly showing the co-ordinates of the vertex and the X and Y intercepts. (3m)

when $x = -1, y = -2$
when $x = 0, y = -1\frac{1}{2}$
when $x = -2, y = -1\frac{1}{2}$
when $x = -3, y = 0$
when $x = 1, y = 0$

①/② graph
①/② y intercept $-1\frac{1}{2}$
①/② root -3
①/② root 1

4. Solve by completing the square, giving the solution in simplest surd form:

$x^2 - 15x + 56 = 0$ (2m)

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4. Solve by completing the square, giving the solution in simple**(** surd form: **)** ← misleading

$x^2 - 15x + 56 = 0$ (2m)

$x^2 - 15x + \dfrac{225}{4} = -56 + \dfrac{225}{4}$

$\left(\dfrac{-15}{2}\right)^2 = \dfrac{225}{4}$

$\left(x - 7\frac{1}{2}\right)^2 = \dfrac{1}{4}$

So $\left(x - 7\frac{1}{2}\right) = \pm\dfrac{1}{2}$

$x = 7\frac{1}{2} \pm \frac{1}{2}$

$= 7\frac{1}{2} + \frac{1}{2} = 8$ ✓ ②

and $7\frac{1}{2} - \frac{1}{2} = 7$ ✓✓

Section 3 (14 Marks)

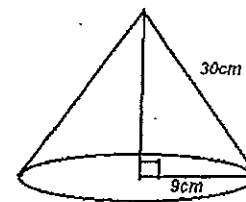5. Write a polynomial of degree 4 that is monic and has a constant term of 6. (1m)

$x^4 + 6$

6. Find the remainder when $(x^5 - 2x^4 + x^3 + x - 3)$ is divided by $(x+4)$ (2m)

$P(-4) = (-4)^5 - 2(-4)^4 + (-4)^3 + (-4) - 3$

$= -1024 - 512 - 64 - 4 - 3$

$= -1607$

7. Find the volume of this cone: (2m)

30cm

9cm

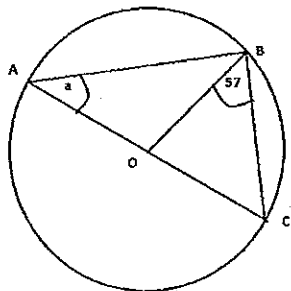$V = \frac{1}{3}\pi r^2 h$ $h = \sqrt{30^2 - 9^2}$

$= \frac{1}{3}\pi (9^2)(3\sqrt{91})$ $= \sqrt{819}$

                     $= 3\sqrt{91}$

$= 81\sqrt{91}\,\pi$ units^3

$= 2427.48$ units^3

(479.94)

8. Find the value of the pronumeral, giving reasons in full. (The centre of the circle is labelled 'O'.)

(2m)

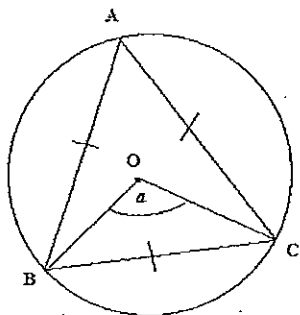In $\triangle$ ABC

$\angle ABC = 90°$ (angle in a semi circle)

In $\triangle$ AOB

$\angle ABO = 90 - 57$ (complement
$= 33°$

$a = \angle BAO = \angle ABO = 33°$
(isosceles $\triangle$, = radii).

$\underline{\underline{a = 33°}}$

9. Find the value of the pronumeral, giving reasons in full. (The centre of the circle is labelled 'O'.)
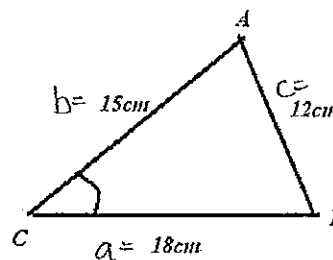
(2m)

In $\triangle$ BAC

$\angle BAC = 60°$ (equilateral $\triangle$)

In $\triangle$ BOC

$a = \angle BOC = 2 \times 60°$
(angle at the centre is twice angle at circumferenc

$\underline{\underline{a = 120°}}$

10. Find the size of angle C:

(2m)

b = 15cm, C = 12cm, a = 18cm

$\cos C = \dfrac{a^2 + b^2 - c^2}{2ab}$

$= \dfrac{18^2 + 15^2 - 12^2}{2(18)(15)}$

$= \dfrac{324 + 225 - 144}{540} = \dfrac{405}{540}$ ∴ $41°25'$

$.40962$

11. Solve this equation:

$2^{2x+1} - 17(2^x) + 8 = 0$

(3m)

$2(2^{2x}) - 17(2^x) + 8 = 0$

$u = 2^x$

$2u^2 - 17u + 8 = 0$

$(2u-1)(u-8) = 0$

$u = \frac{1}{2} = 2^x$ $u = 8 = 2^x$

∴ $x = -1$ $x = 3$

Section 4 (14 Marks)

1. Solve this equation by using the quadratic formula, giving the solution in simplest surd form: $3x^2 + 2x - 2 = 0$ **(2m)**

$$x = \frac{-2 \pm \sqrt{2^2 - 4 \times 3 \times -2}}{1 \quad 6}$$

$$= \frac{-2 \pm \sqrt{28}}{6}$$

$$= \frac{-1 \pm \sqrt{7}}{3}$$

2. Solve these equations simultaneously: **(3m)**

$$x^2 + y^2 = 169$$
$$x - y = -7$$

$$x = y - 7$$
$$y^2 - 14y + 49 + y^2 = 169$$
$$2y^2 - 14y - 120 = 0$$
$$y^2 - 7y - 60 = 0$$
$$(y - 12)(y + 5) = 0$$
$$y = 12, -5$$
$$x = 5, -12$$

3. In a History test the mean was 61 and the standard deviation was 9. In a Science test the mean was 70 and the standard deviation 10. Elizabeth scored 75 in her history test and Jason scored 75 in his Science test. Who had the better score? Explain. **(1m)**

ELIZABETH as score 1.6 so above the mean
Jason was only $\approx$ 0.5 so "

4. How much must I invest now in order to have $10 000 at the end of 5 years, if interest is 3%p.a. compounding quarterly? **(2m)**

$$10\,000 = P\left(1 + \frac{3}{400}\right)^{20}$$
$$P = 10\,000\left(1 + \frac{3}{400}\right)^{-20}$$
$$= \$8611.90$$

5. Which rate will give the better return on an investment: 13% p.a. compounding annually or 12.5% p.a. compounding monthly? Show working. **(2m)**
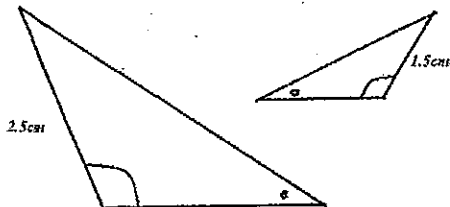
After 1 year @ 13%p.a $A = P(1.13)^1 = 1.13P$

After 1 year @ 12.5% math $A = P\left(1 + \frac{12.5}{1200}\right)^{12} = 1.132P$

12.5% compounded monthly is better

6. For the following pair of similar triangles, state the ratio (in simplest form) of the area of the first triangle to the area of the second triangle. **(2m)**

ratio of sides 2.5 to 1.5

$5:3$

ratio of area $5^2 : 3^2$

$= 25:9$

7. The ratio of the heights of two similar gas cylinders is 2 : 3. If 4 kg of gas fills the smaller cylinder, how much gas is needed to fill the larger one?

(2m)

ratio heights $2:3$

ratio volumes $2^3 : 3^3 = 8.27$

Small 4kg of gas/lge need $\frac{27}{2}$ kg

13.5 kg

Section 5 (15 Marks)

1. Solve the following equations: **(4m)**

a) $x^6 - 28x^3 + 27 = 0$

$(x^3 - 27)(x^3 - 1) = 0$

$x^3 = 27$, $x^3 = 1$

$x = 3$, $x = 1$

②

b) $(2x-5)^2 = 2x - 5$

$(2x-5)^2 - (2x-5) = 0$

$(2x-5)(2x-6) = 0$

$x = \frac{5}{2}$, 3

$4x^2 - 20x + 25 = 2x - 5$

$4x^2 - 22x + 30 = 0$

$2x^2 - 11x + 15 = 0$

$(2x-5)(x-3) = 0$ ②

$x = \frac{5}{2}$, 3

2. Find the centre and radius of the circle

$x^2 + y^2 - 16x - 2y + 56 = 0$ **(2m)**

$x^2 - 16x + y^2 - 2y = -56$

$x^2 - 16x + (-8)^2 + y^2 - 2y + (-1)^2 = -56 + 64 + 1$

$(x-8)^2 + (y-1)^2 = 9$
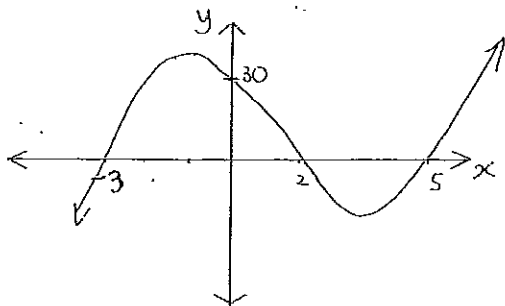
∴ Centre $(8, 1)$ and radius 3

②

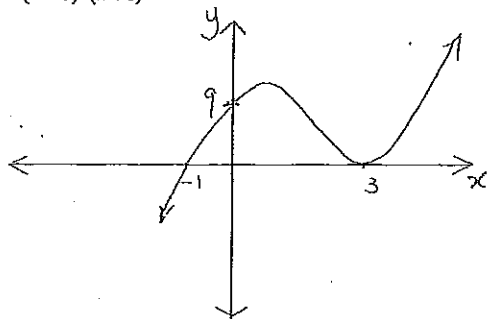3. Sketch the following curves labelling all x and y intercepts:
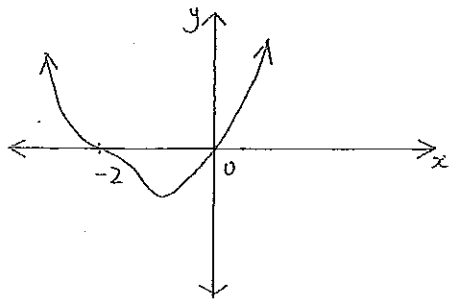
(6m)

a) $y = (x+3)(x-2)(x-5)$

②

b) $y = (x-3)^2(x+1)$

②

c) $y = x(x+2)^3$

②

4. Factorise fully: $P(x) = 2x^3 + 5x^2 - 4x - 12$ (3m)

$$P(-2) = 2(-2)^3 + 5(-2)^2 - 4(-2) - 12$$

$$P(-2) = 0$$

①

$\therefore x = -2$ is a   root.

$$
\begin{array}{r}
2x^2 + x - 6 \\
x+2 \overline{\smash{)}\ 2x^3 + 5x^2 - 4x - 12} \\
2x^3 + 4x^2 \\
\hline
x^2 - 4x - 12 \\
x^2 + 2x \\
\hline
-6x - 12 \\
-6x - 12 \\
\hline
0
\end{array}
$$

①

$\therefore P(x) = (x+2)(2x^2 + x - 6)$

$= (x+2)(2x-3)(x+2)$

$\boxed{P(x) = (x+2)^2(2x-3)}$

①

1. Find k, given that $kx^3 + 4x^2 - 4$ is divisible by $x + 2$. [2]
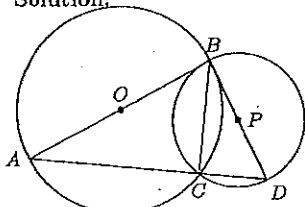
> **Solution:** $P(x) = kx^3 + 4x^2 - 4.$
> $$P(-2) = -8k + 16 - 4 = 0,$$
> $$-8k = -12,$$
> $$k = \frac{3}{2}.$$

2. When $Q(x) = ax^3 + bx^2 + 2x + 3$ is divided by $(x + 1)$, the remainder is 3. [3]
When $Q(x)$ is divided by $(x - 1)$, the remainder is 15. Find a and b.

> **Solution:**
> $$Q(-1) = -a + b - 2 + 3 = 3,$$
> $$Q(1) = a + b + 2 + 3 = 15,$$
> i.e. $-a + b = 2 \ldots\ldots\ldots$ [1]
> $a + b = 10 \ldots\ldots\ldots$ [2]
> [1]+[2]: $2b = 12,$
> $b = 6.$
> Subst. in [2]: $a + 6 = 10,$
> $a = 4.$

3. Two circles intersect at B and C. AB and BD are diameters. [3]
Prove that A, C and D are collinear.

> **Solution:**
>
> Draw BC,
> $A\widehat{C}B = 90°$ ($\angle$ in a semicircle)
> $B\widehat{C}D = 90°$ ($\angle$ in a semicircle)
> $\therefore A\widehat{C}D = 180°.$
> i.e. A, C and D are collinear.

4. The Department of Primary Industry is interested in the effect of a new fertilizer [3]
on the growth of maize plants. After 12 months growth, the heights (in cm) of the
plants in two plots were measured and found to be as follows:

Plot A (New Fertilizer)
39   48   50   47   125   46   54   59   58   59
127   48   44   51   53

Plot B (Original Fertilizer)
65   55   59   60   63   57   58   61   62   60
59   63   60   61   57

(a) Calculate the mean and standard deviation of the two samples.

> **Solution:**
>
> | Plot | $\bar{x}$ | σ |
> |------|-----------|----------|
> | A | 60.533 | 26.245 |
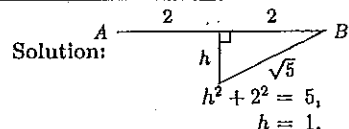> | B | 60 | 2.556 |

(b) Using these results, compare the effectiveness of the different fertilizers on the
growth of maize plants.

> **Solution:** The new fertilizer gave more varied results than the old
> (i.e. much higher highs but also lower lows) and had less
> than 1% overall improvement.

5. AB is a chord. Find the equation of the circle, given that $r = \sqrt{5}$. [3]
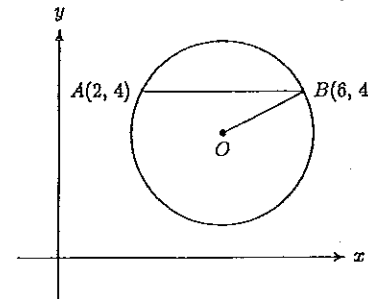
> **Solution:**
> $$h^2 + 2^2 = 5,$$
> $$h = 1.$$
> $\therefore$ Centre $(4, 3)$.
> Circle $(x - 4)^2 + (y - 3)^2 = 5,$
> $$x^2 - 8x + 16 + y^2 - 6y + 9 = 5,$$
> $$x^2 - 8x + y^2 - 6y + 20 = 0.$$

Section 7 (15 Marks)

1. A ship leaves port and heads on a bearing of 145°T travelling at 17km/h. After 8 hours it alters course to a bearing of 253°T and continues at the same speed for another 12 hours. It then receives a report of a cyclone developing in the area. The ship increases speed to 21km/h and heads directly back to port.   (5m)

a) How long will it take to get back to port?

17 Km/h
136 Km/8h
204 Km/12h
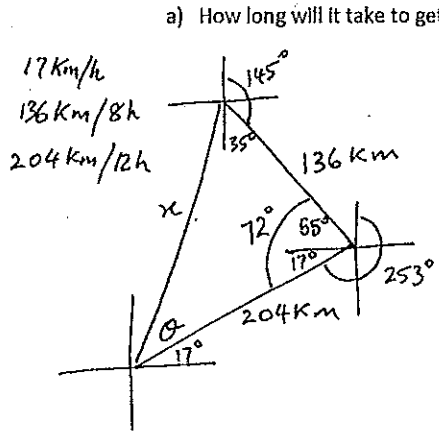
$x^2 = 136^2 + 204^2 - 2(136)(204)\cos 72°$
$\quad = 4296.5.265...$
$x = 207.28$ Km

$t = \dfrac{207.28}{21}$

$= 9$ hours 52 minutes 13.82 seconds

b) On what bearing (to the nearest minute) should it head?

$\dfrac{\sin\theta}{136} = \dfrac{\sin 72°}{207.28}$

$\sin\theta = \dfrac{136\sin 72°}{207.28}$

$\theta = 38°37'$

$90 - (38°37' + 17°)$

$= 34°23'$

$\therefore$ bearing is $034°23'T$

---

2. Solve: $\sqrt{x+\sqrt{x}} + \sqrt{x-\sqrt{x}} = 3\sqrt{\dfrac{x}{x+\sqrt{x}}}$ (3m)

$\sqrt{x+\sqrt{x}} + \sqrt{x-\sqrt{x}} = \dfrac{3\sqrt{x}}{\sqrt{x+\sqrt{x}}}$

$x+\sqrt{x} + \sqrt{x-\sqrt{x}}.\sqrt{x+\sqrt{x}} = 3\sqrt{x}$

$x+\sqrt{x} + \sqrt{x^2-x} = 3\sqrt{x}$

$\sqrt{x^2-x} = 2\sqrt{x} - x$

$x^2 - x = 4x - 4x\sqrt{x} + x^2$

$4x\sqrt{x} = 5x$
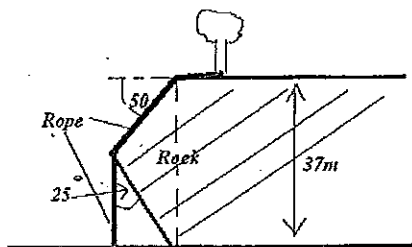
$16x^3 = 25x^2$

$16x^3 - 25x^2 = 0$

$x^2(16x - 25) = 0$

$x = 0, \dfrac{25}{16}$

since $x \neq 0$

$x = \dfrac{25}{16}$

3. A cliff is 37m high. The rock slopes outward at an angle of 50° to the horizontal, then cuts back at an angle of 25° to the vertical, meeting the ground directly below the top of the cliff.

NOT TO SCALE

Carol wishes to abseil from the top of the cliff to the ground as shown in the diagram. Her climbing rope is 45m long and she needs 2m to secure it to a tree at the top of the cliff. Will the rope be long enough to allow her to reach the ground?

(3m)
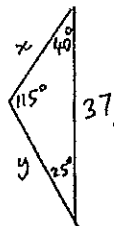
$$\frac{x}{\sin 25°} = \frac{37}{\sin 115°}$$
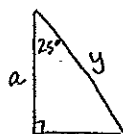
$$x = \frac{37 \sin 25°}{\sin 115°}$$

$$x = 17.25....$$

$$\frac{y}{\sin 40°} = \frac{37}{\sin 115°}$$

$$y = \frac{37 \sin 40°}{\sin 115°}$$

$$y = 26.24....$$

$$\cos 25° = \frac{a}{y}$$

$$a = y \cos 25°$$

$$a = 23.78....$$

$$17.25 + 23.78 + 2 = \underline{\underline{43.04}}$$

which is less than 45
∴ the rope is long enough.

4. A boy plans a boating trip from his home on the edge of a lake to a town that lies on a river that empties into the lake. To make the trip, he travels 20km across the lake (in which there is no current) to the mouth of the river, and then rows a further 20km up the river against a current of 2km/hour. If the journey is completed in 15 hours, at what constant speed (relative to the water) does he travel?

(4m)

let boy travel at x Km/h

$$\frac{20}{x} + \frac{20}{x-2} = 15$$

$$20(x-2) + 20x = 15x(x-2)$$

$$20x - 40 + 20x = 15x^2 - 30x$$

$$15x^2 - 70x + 40 = 0$$

$$3x^2 - 14x + 8 = 0$$

$$\frac{(3x - 12)(3x - 2)}{3} = 0$$

$$(x-4)(3x-2) = 0$$

$$x = 4, \frac{2}{3} \qquad \text{Note: } x > 2$$

$$\therefore x = 4 \text{ Km/h}$$

$$x \begin{array}{|c} 2 \cdot 4 \\ \hline -14 \end{array}$$
$$+ \qquad \begin{array}{c} -12 \\ -2 \end{array}$$