

SECTION A **64** NAME: Solution

1 [4 marks]

Solve $2x^2 + 4x - 5 = 0$ using the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

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

$$x = \frac{-4 \pm \sqrt{16 - 4 \times 2 \times -5}}{2 \times 2} \quad \checkmark \text{ (sub)}$$

$$= \frac{-4 \pm \sqrt{16 + 40}}{4}$$

$$= \frac{-4 \pm \sqrt{56}}{4} \quad \checkmark$$

$$= \frac{-4 + \sqrt{56}}{4} \quad \checkmark \text{ or } \frac{-4 - \sqrt{56}}{4} \quad \checkmark$$

$$0.8708$$

$$-2.8708$$

2 [4 marks]

a) Circle the correct answer:

In turning point form, the quadratic equation $y = x^2 - 8x + 18$ can be written as:

A $y = (x - 4)^2 + 34$

B $y = (x + 4)^2 + 2$

C $y = (x - 4)^2 - 2$

D $y = (x + 4)^2 - 2$

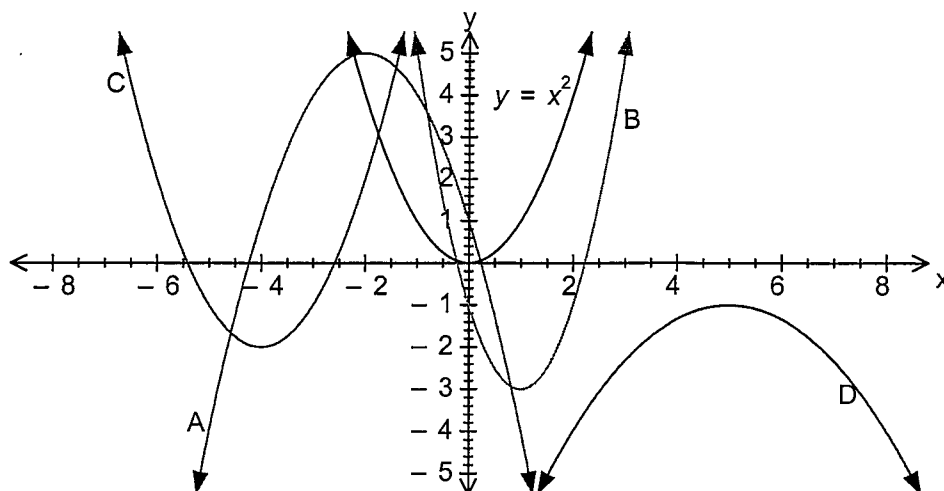
(E) $y = (x - 4)^2 + 2$

$$y = (x^2 - 8x + 16) - 16 + 18 \\ = (x - 4)^2 + 2$$

b) Hence write down the coordinates of the turning point for the parabola $y = x^2 - 8x + 18$

$$TP = (+4, 2) \quad \checkmark$$

3 [8 marks]



Circle the correct answer:

a) The equation of parabola A is:

A $y = (x+2)^2 + 5$

B $y = (x-2)^2 + 5$

☒ C $y = -(x+2)^2 + 5$

D $y = -(x-2)^2 + 5$

E $y = -(x+2)^2 - 5$

2

$\wedge \therefore a < 0, TP = (-2, 5)$

b) The equation of parabola B is:

☒ A $y = 2(x-1)^2 - 3$

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

C $y = -2(x-1)^2 - 3$

D $y = \frac{1}{2}(x+1)^2 - 3$

E $y = \frac{1}{2}(x-1)^2 - 3$

2

$\vee \therefore a > 0 \rightarrow a = 2, TP = (1, -3)$

c) The equation of parabola C is:

A $y = (x-4)^2 - 2$

☒ B $y = (x+4)^2 - 2$

C $y = (x-4)^2 + 2$

D $y = (x+4)^2 + 2$

E $y = -(x-4)^2 + 2$

2

$\vee \therefore a > 0, TP = (-4, -2)$

d) The equation of parabola D is:

A $y = 3(x-5)^2 - 1$

☒ B $y = -\frac{1}{3}(x-5)^2 - 1$

C $y = -3(x-1)^2 - 5$

D $y = \frac{1}{3}(x-1)^2 - 5$

E $y = -\frac{1}{3}(x+5)^2 - 1$

2

$\wedge \therefore a < 0 \rightarrow a = -\frac{1}{3}, TP = (5, -1)$

4 [12 marks] Determine the relationship between y and x for each of the following

a)

x	0	1	2	3	4
y	3	5	7	9	11

$\underbrace{\quad\quad}_2 \underbrace{\quad\quad}_2 \underbrace{\quad\quad}_2 \underbrace{\quad\quad}_2$

Linear

$$y = 2x + 3$$

Give 1/2 for stating correct r/ship

2

b)

x	0	1	2	3	4
y	-2	2	14	34	62

$\underbrace{\quad\quad}_4 \underbrace{\quad\quad}_{12} \underbrace{\quad\quad}_{20} \underbrace{\quad\quad}_{28}$
 $\underbrace{\quad\quad}_8 \underbrace{\quad\quad}_8 \underbrace{\quad\quad}_8$

Quadratic

$$a = 4, c = -2, a + b = 4$$

$$\therefore b = 0$$

$$y = 4x^2 - 2$$

3

c)

x	1	2	3	4
y	24	12	8	6

$$xy = k$$

Reciprocal

$$xy = 24$$

2

d)

x	0	1	2	3	4
y	5	10	20	40	80

$\times 2 \times 2 \times 2 \times 2$

Exponential

$$y = ka^x$$

$$y = 5 \times 2^x$$

3

e)

x	1	2	0	-1	-2
y	-5	-7	-3	-1	1

Linear

$$y = -1 + 2x - 3$$

2

$x \quad -2 \quad -1 \quad 0 \quad 1 \quad 2$

$y \quad 1 \quad -1 \quad -3 \quad -5 \quad -7$
 $\underbrace{\quad\quad}_{-2} \underbrace{\quad\quad}_{-2} \underbrace{\quad\quad}_{-2} \underbrace{\quad\quad}_{-2}$

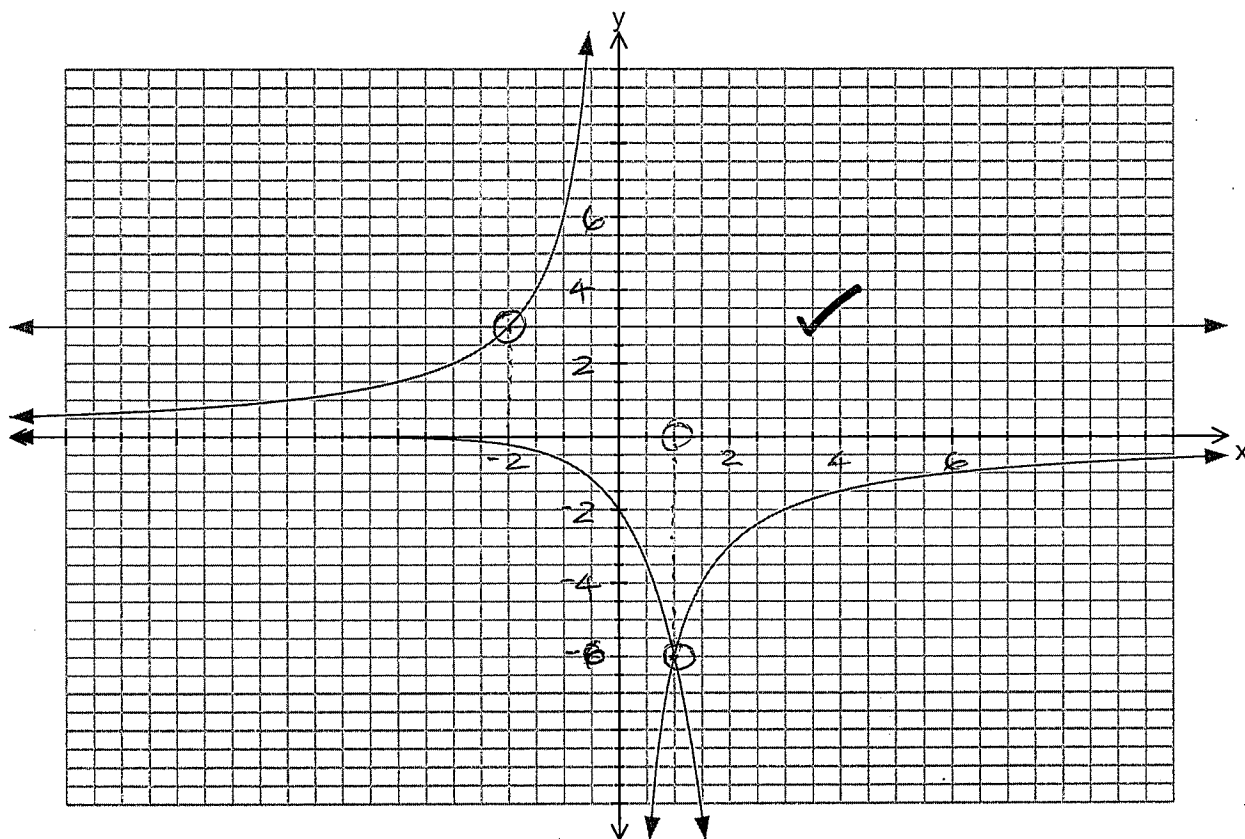
5 [7 marks]

a) Sketch the graphs of the following:

$$y = -2 \times 3^x$$

$$y = \frac{-6}{x}$$

4

b) Using your graph, find the solution to the equations

i) $-2 \times 3^x = \frac{-6}{x}$

$$x = 1$$

ii) $\frac{-6}{x} = 3$

$$x = -2$$

2

Must show
on graph
to get
the mark

-1 for no labels, arrows etc.

6. [15 marks – 2, 2, 3, 3, 3, 2]

Completely factorise the following:

a) $9m^2 - 25n^2$

$$= (3m - 5n)(3m + 5n)$$

2

b) $x^2 + 9x - 36$

$$= (x + 12)(x - 3)$$

2

c) $12x^2 + 2x - 24$

$$= 2(6x^2 + x - 12)$$

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

3

d) $6x^3 + 3x^2 - 3x$

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

$$= 3x(2x - 1)(x + 1)$$

3

e) $x^2 - y^2 + 5x - 5y$

$$= (x - y)(x + y) + 5(x - y)$$

$$= (x - y)(x + y + 5)$$

3

f) $(j - b)^2 - 16$

$$= (j - b - 4)(j - b + 4)$$

2

7. [7 marks – 3, 4]

Express the following as a single fraction in simplest form.

a) $\frac{3}{x-5} - \frac{2}{x+4}$

$$= \frac{3(x+4) - 2(x-5)}{(x-5)(x+4)}$$

$$= \frac{3x + 12 - 2x + 10}{(x-5)(x+4)}$$

$$= \frac{x + 22}{(x-5)(x+4)}$$

3

$$\begin{aligned}
 \text{b) } & \frac{7}{(5x-2)(x-6)} + \frac{2}{x^2-2x-4} \\
 &= \frac{7}{(5x-2)(x-6)} + \frac{2}{(x+4)(x-6)} \checkmark \\
 &= \frac{7(x+4) + 2(5x-2)}{(5x-2)(x-6)(x+4)} \checkmark \\
 &= \frac{7x+28+10x-4}{(5x-2)(x-6)(x+4)} \checkmark \\
 &= \frac{17x+24}{(5x-2)(x-6)(x+4)} \checkmark
 \end{aligned}$$

4

8. [7 marks – 3, 4]

Simplify the following expressions:

$$\begin{aligned}
 \text{a) } & \frac{x^2-5x}{3x+3} \times \frac{x+1}{2x^2+6x} \\
 &= \frac{x(x-5)}{3(x+1)} \times \frac{(x+1)}{2x(x+3)} \checkmark \\
 &= \frac{(x-5)}{6(x+3)} \checkmark
 \end{aligned}$$

3

$$\begin{aligned}
 \text{b) } & \frac{x^2-16}{x^2+2x-3} \div \frac{x^2+2x-8}{x^2+6x-7} \\
 &= \frac{(x-4)(x+4)}{(x-1)(x+3)} \times \frac{(x-1)(x+7)}{(x-2)(x+4)} \checkmark \\
 &= \frac{(x-4)(x+7)}{(x+3)(x-2)} \checkmark
 \end{aligned}$$

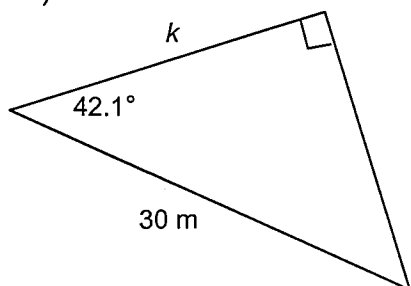
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SECTION B 61 NAME: Solutions

9. [4 marks]

Find the value of k in these triangles to two decimal places.

a)

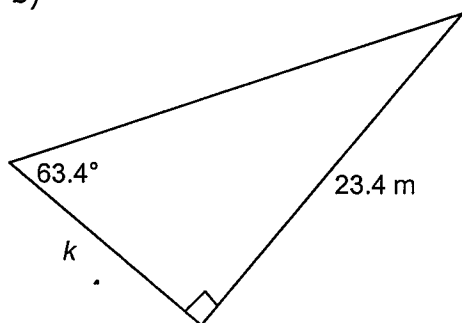


$$\cos 42.1^\circ = \frac{k}{30} \checkmark$$

$$k = 22.26 \text{ m} \checkmark$$

2

b)



$$\tan 63.4^\circ = \frac{23.4}{k} \checkmark$$

$$k = \frac{23.4}{\tan 63.4^\circ} = 11.72 \text{ m} \checkmark$$

2

10. [6 marks]

Find the value of θ for the domain indicated.

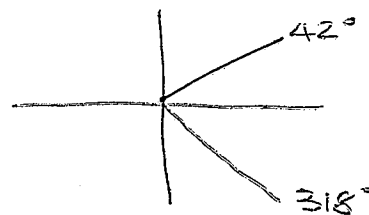
a) $\cos \theta = 0.74$

$0^\circ \leq \theta \leq 360^\circ$

$$\theta = 42^\circ \text{ or } 360^\circ - 42^\circ$$

$$= 42^\circ \text{ or } 318^\circ \checkmark$$

2



b) $\sin \theta = 0.4609$

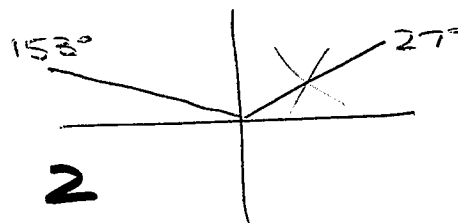
$90^\circ \leq \theta \leq 180^\circ$

$$\theta = 27^\circ \text{ or } 180^\circ - 27^\circ$$

X

No solution

$$\therefore \theta = 153^\circ \checkmark$$



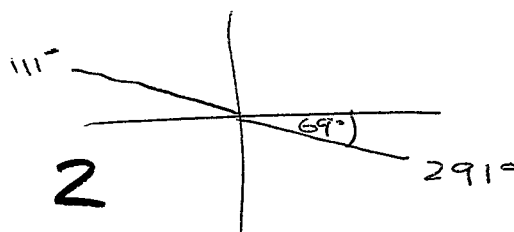
2

c) $\tan \theta = -2.645$

$0^\circ \leq \theta \leq 360^\circ$

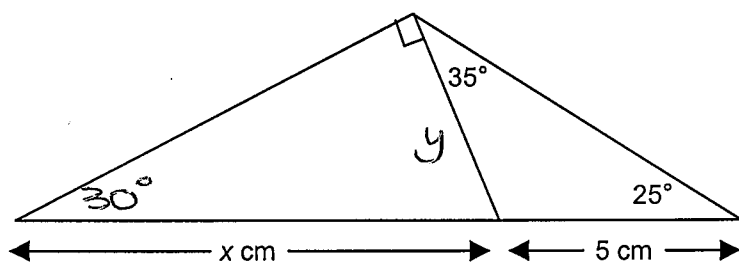
(Calculator) $\theta = -69^\circ$ or $180^\circ - 69^\circ$

$\theta = 291^\circ$ or 111°



11. [4 marks]

Solve for the variable in the diagram:



$$\frac{y}{\sin 25^\circ} = \frac{5}{\sin 35^\circ} \checkmark$$

$$y = 3.684 \dots \checkmark$$

$$\sin 30^\circ = \frac{3.684 \dots}{x}$$

$$x = \frac{3.684 \dots}{\sin 30^\circ} \checkmark$$

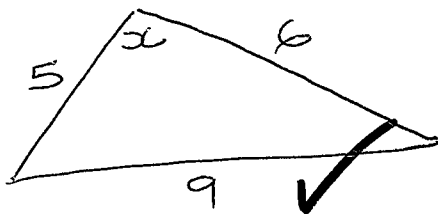
$$= 7.37 \text{ cm } \checkmark (2 \text{ dp})$$

$$\text{or } 7.368 \text{ cm } (3 \text{ dp})$$

4

12. [3 marks]

What is the size of the largest angle in a triangle that has sides of length 5 cm, 6 cm and 9 cm?



$$\cos x = \frac{5^2 + 6^2 - 9^2}{2 \times 5 \times 6} \checkmark$$

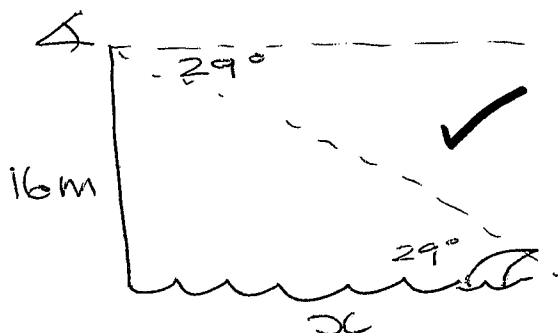
$$= -0.333 \dots$$

$$x = 109.471^\circ \checkmark (3 \text{ dp})$$

3

13. [3 marks]

A lifeguard on watch at a beach spots a shark at an angle of depression of 29° . If the lifeguard views the shark from a height (to his eye-level) of 16 m above sea-level, find the horizontal distance between the lifeguard and the shark, correct to two decimal places.



$$\tan 29^\circ = \frac{16}{x} \checkmark$$

$$x = \frac{16}{\tan 29^\circ}$$

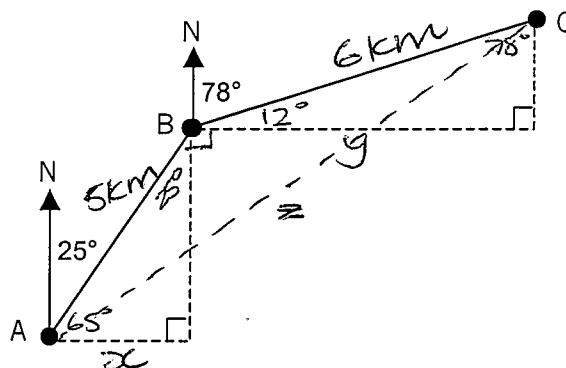
$$x = 28.86 \text{ m} \checkmark$$

3

14. [6 marks]

A hiker walks 5 km on a true bearing of 025° from camp site A to camp site B. All distances are to be rounded to two decimal places.

a) How far east has she walked?



$$\cos 65^\circ = \frac{x}{5} \quad \checkmark$$

$$x = 5 \times \cos 65^\circ$$

$$= 2.11 \text{ km} \quad \checkmark$$

$$\left(\text{or } \sin 25^\circ = \frac{x}{5} \right) \quad 2$$

She then continues another 6 km on a true bearing of 078° from camp site B to camp site C.

b) How far east of camp B is she now?

$$\cos 12^\circ = \frac{y}{6} \quad \checkmark$$

$$y = 6 \times \cos 12^\circ$$

$$= 5.87 \text{ km} \quad \checkmark$$

$$\left(\text{or } \sin 78^\circ = \frac{y}{6} \right)$$

2

c) Calculate the distance between Camp A and Camp C

$$\angle B = 90^\circ + 12^\circ + 25^\circ$$

$$= 127^\circ \quad \checkmark$$

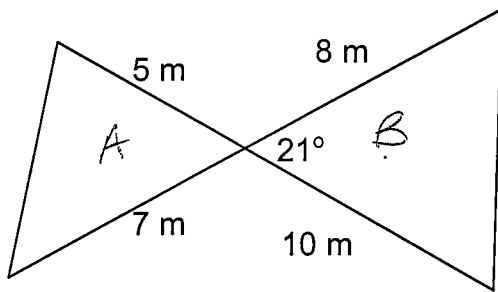
$$z^2 = 5^2 + 6^2 - 2 \times 5 \times 6 \times \cos 127^\circ \quad \checkmark$$

$$= 97.108 \dots$$

$$z = 9.85 \text{ km} \quad \checkmark$$

3

15. [4 marks]

Find the area enclosed by the figure (to the nearest m^2)

$$\text{Area A} = \frac{1}{2} \times 5 \times 7 \times \sin 21^\circ$$

$$= 6.27 \dots \text{m}^2$$

$$\text{Area B} = \frac{1}{2} \times 8 \times 10 \times \sin 21^\circ$$

$$= 14.33 \dots \text{m}^2$$

$$\text{Total Area} = 21 \text{m}^2$$

4

16. [3 marks]

A box contains 15 blocks. Seven are red, five are white and the rest are blue. A block is chosen at random from the box. Find the probability that the block chosen is:

a) blue

$$\frac{3}{15} = \frac{1}{5} \checkmark$$

b) not red

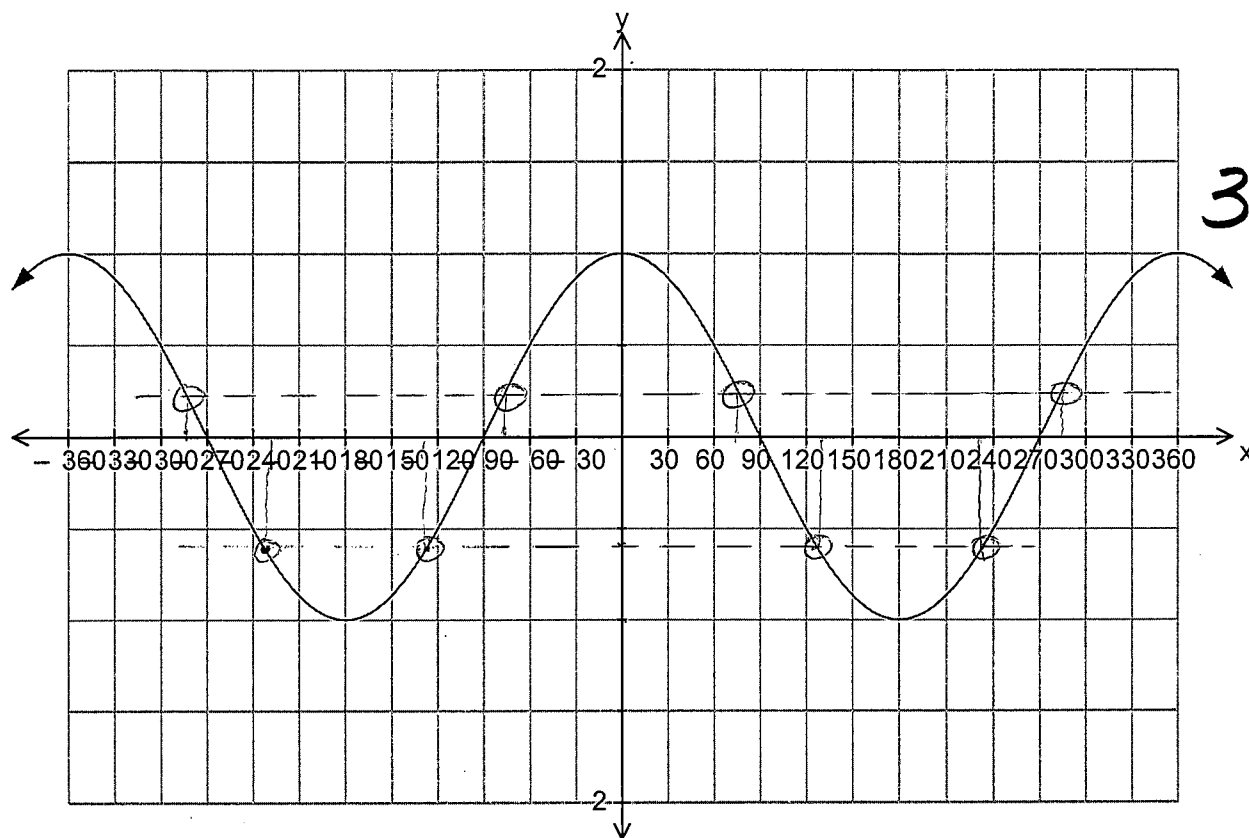
$$\frac{8}{15} \checkmark$$

c) red or blue

$$\frac{10}{15} = \frac{2}{3} \checkmark$$

3

17. [9 marks]

Sketch the graph of $y = \cos \theta$ for the domain $-360^\circ \leq \theta \leq 360^\circ$ 

From the graph, solve:

a) $\cos \theta = -0.6$

$$\theta \approx 125^\circ, 235^\circ, -125^\circ, -235^\circ \quad 2$$

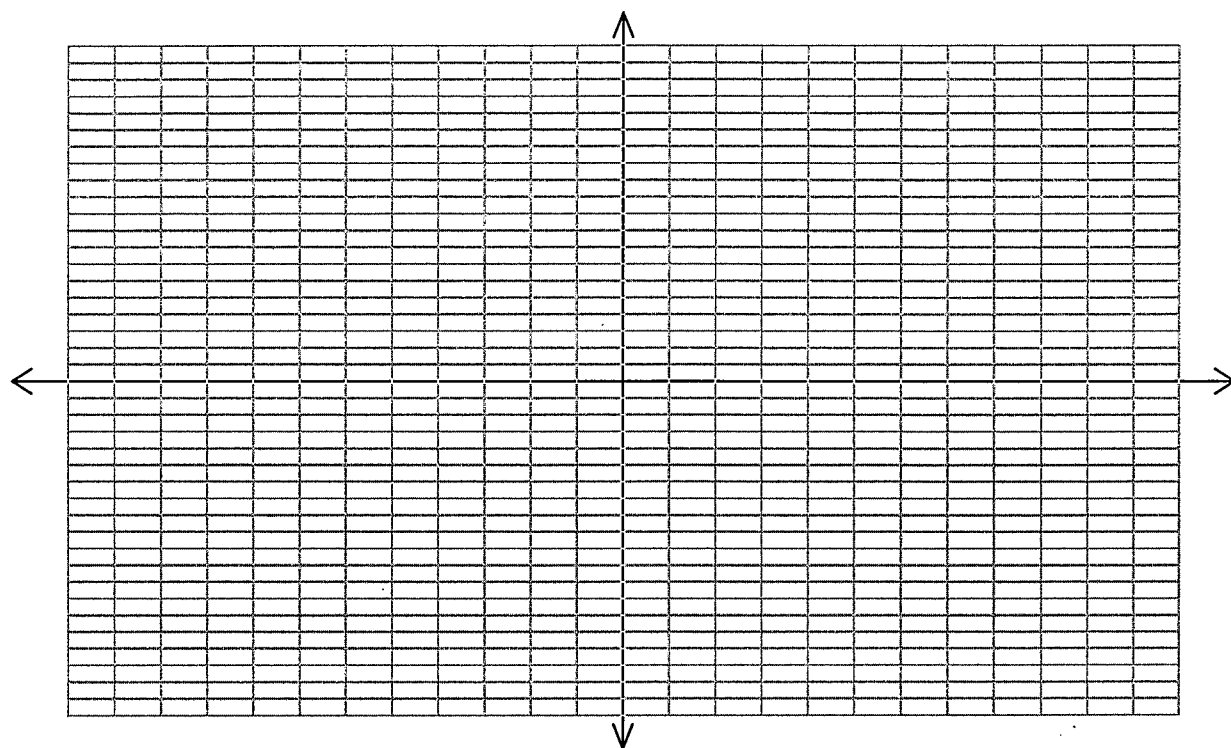
b) $\cos \theta = 0.2$

$$\theta \approx 75^\circ, 275^\circ, -75^\circ, -275^\circ \quad 2$$

c) Give the values of θ when $y < 0$.

$$-270^\circ \leq \theta \leq -90^\circ \text{ and } 90^\circ \leq \theta \leq 270^\circ \quad 2$$

17. [9 marks]

Sketch the graph of $y = \cos \theta$ for the domain $-360^\circ \leq \theta \leq 360^\circ$ 

From the graph, solve:

a) $\cos \theta = -0.6$

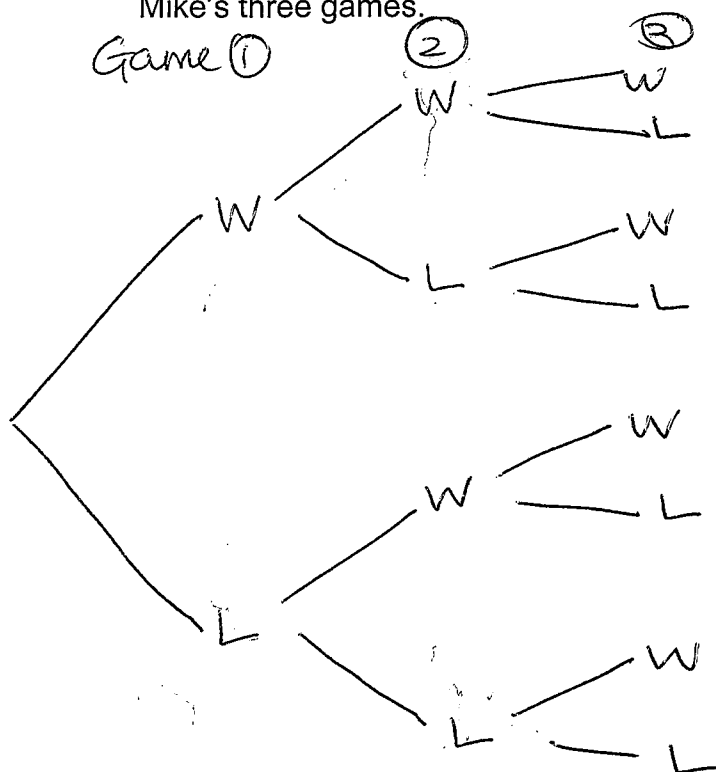
b) $\cos \theta = 0.2$

c) Give the values of θ when $y < 0$.

18. [10 marks]

In a chess tournament, each contestant must play three others. Mike estimates that he has an equal chance of winning or losing each game.

- a) Draw a tree diagram and list the sample space for the possible outcomes of Mike's three games.



WWW
WWL

WLW
WLL

LWW

LWL

LLW

LLL

3

- b) How many possible outcomes are there?

8 ✓

- c) What is the probability of Mike:

- i) winning all three games?

$\frac{1}{8}$ ✓

- ii) winning only one game?

$\frac{3}{8}$ ✓

- iii) winning the first game?

$\frac{4}{8} = \frac{1}{2}$ ✓

- iv) not winning the third game?

$\frac{4}{8} = \frac{1}{2}$ ✓

- v) winning at least two games?

$\frac{4}{8} = \frac{1}{2}$ ✓

- vi) not winning the first two games?

$\frac{2}{8} = \frac{1}{4}$ ✓

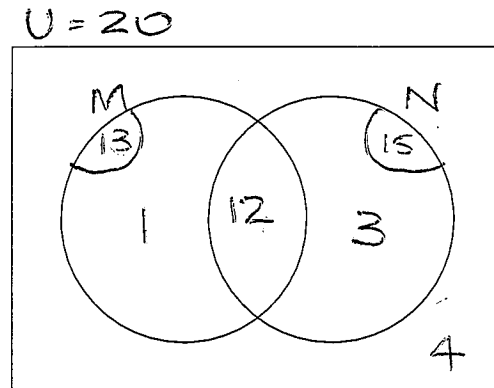
$\frac{3}{4}$

7

19. [8 marks]

A shopkeeper found that, out of his first 20 customers, 13 bought milk and 15 bought a newspaper. Four customers did not buy either milk or a newspaper.

a) Represent this information on the Venn diagram



3

b) How many customers bought both milk and newspaper? 12 ✓

c) Find the probability that a customer, chosen at random from the first 20:

- | | | | |
|------|---------------------------|-------------------------------|---|
| i) | buys milk only | $\frac{1}{20}$ | ✓ |
| ii) | buys milk and a newspaper | $\frac{12}{20} = \frac{3}{5}$ | ✓ |
| iii) | buys milk or a newspaper | $\frac{16}{20} = \frac{4}{5}$ | ✓ |
| iv) | does not buy a newspaper | $\frac{5}{20} = \frac{1}{4}$ | ✓ |

5

END OF EXAMINATION