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**MATHEMATICS**

**SPECIALIST**

**UNIT 3**

**Semester One**

**2019**

**SOLUTIONS**

***Calculator−free Solutions***

1.

✓✓

units ✓

and only solution ✓ [4]

2. (a) (i)

✓✓

(ii) is another factor ✓

(iii)

✓

Leading term: ✓

Constant: ✓

✓

Solutions

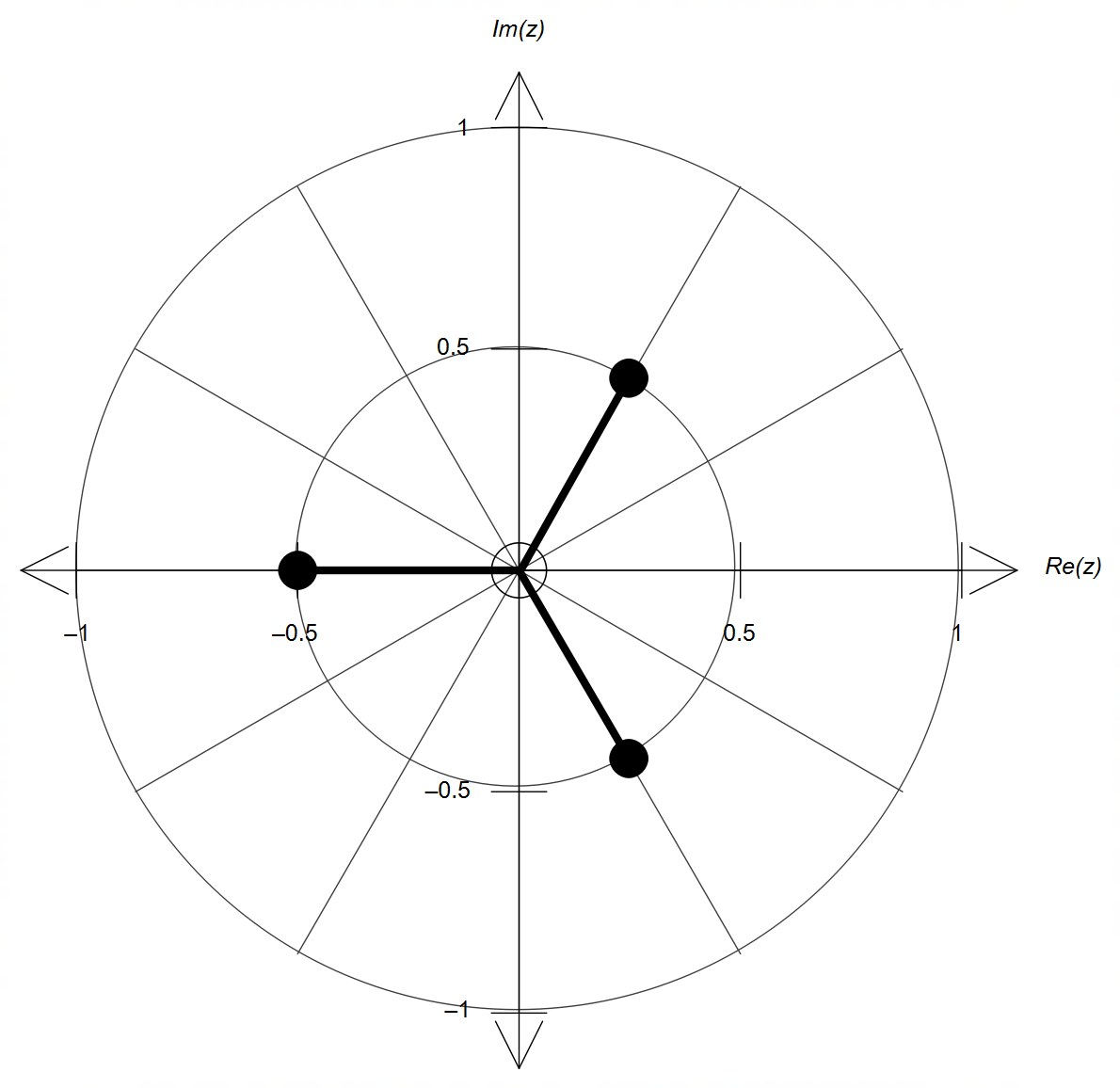
(b)

✓

✓

✓

✓



✓ magnitude = 0.5

✓ radians apart

[13]

3. (a)

✓

✓

✓

(b) Entering equation into a matrix gives:

Using row-reduction in one step gives:

✓

From the last row: ✓

and . ✓

(c) (i)

the normal to the plane is parallel to direction vector of the line,

✓

hence, accept values that are multiples of as follows:

✓

(ii) Using , the line becomes

✓

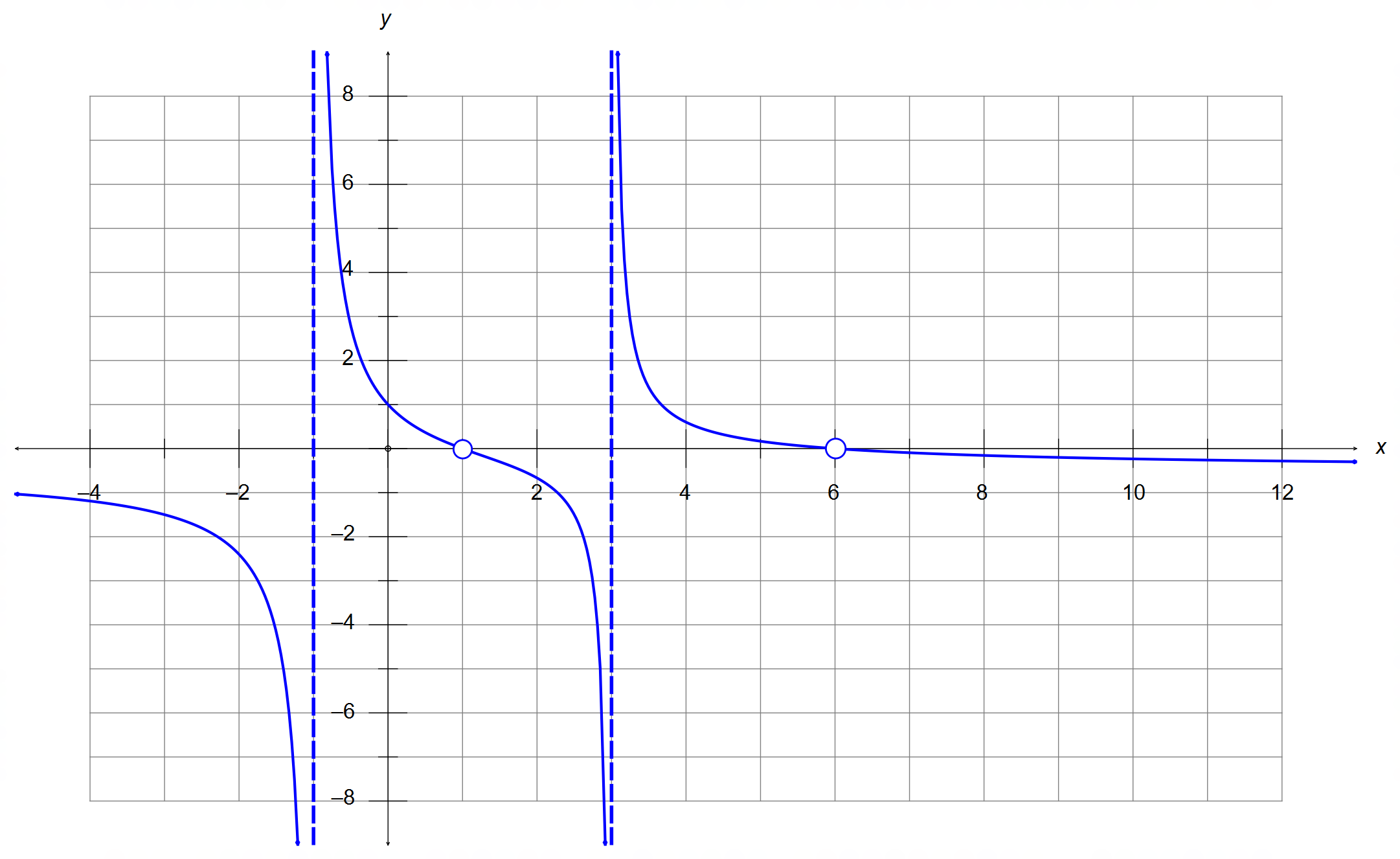
✓

Coordinates of POI are ✓ [11]

4. (a) Roots: or ✓✓

Poles: or ✓✓

y-intercept: ✓



(b)

✓ poles at x = -1,3

✓discontinuities at roots x = 1,6

✓ y-intercept (0,1)

✓ correct curvature around x = 1

✓ correct curvature for x > 3 and x < -1

(c) from symmetry over the y-axis ✓ [11]

5. (a) From the graphs:

for , hence need ✓

but only

and for , and hence ✓

(b) and ✓

✓

(c) Need and ✓

Hence, and

Domain ✓✓

Range stays the same ✓ [8]

6. (a) Centre is midpoint between P and Q = ✓

Radius ✓

✓

(b) is normal to the plane, hence ✓

✓

(simplified) ✓ [6]

***Calculator−Assumed Solutions***

7. Let with

✓

✓

✓

✓ [4]

8. (a) (i)

since the z-coordinate is already of magnitude 1, then

the x ad y coordinates must be zero. Hence,

and ✓✓

(ii) ✓

✓

and ✓✓

(b) ✓

and ✓

If ΔABC equilateral, then

✓

✓ [10]

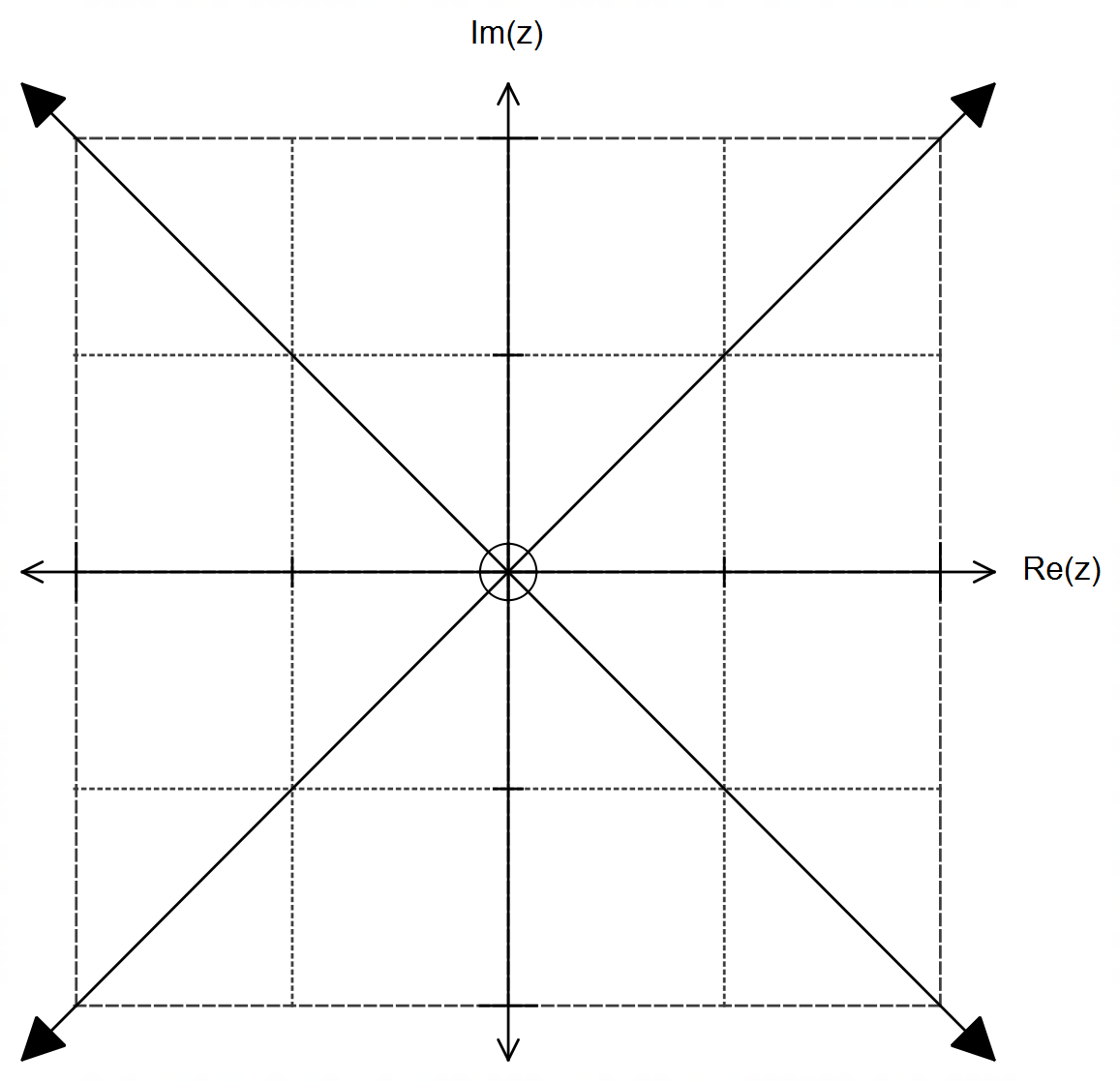
9. (a) ✓✓✓

(b) ✓✓✓

(c)

✓

two lines through the origin. ✓



✓✓

[10]

10. (a) ✓✓

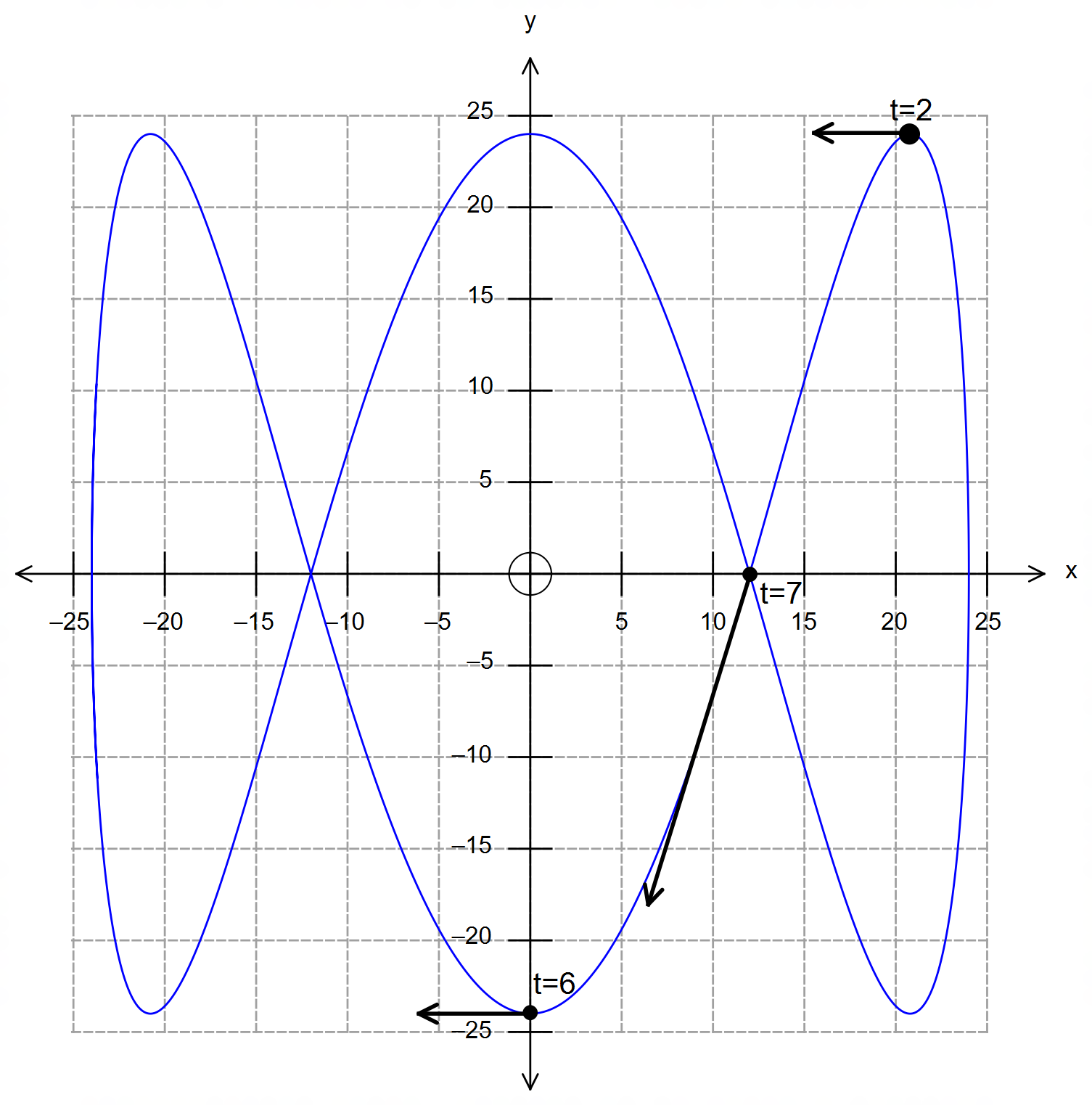
(b)

cm ✓

cm/s ✓

cm ✓

cm/s ✓



✓(b)

✓(f)

✓(b)

(c) sec ✓

(d) ✓

✓

10. (e)

✓✓

(f) CAS cm/s at s ✓✓

cm ✓ [17]

11. (a) OR ✓✓

(b) ✓✓

(c) ✓✓

✓✓ [8]

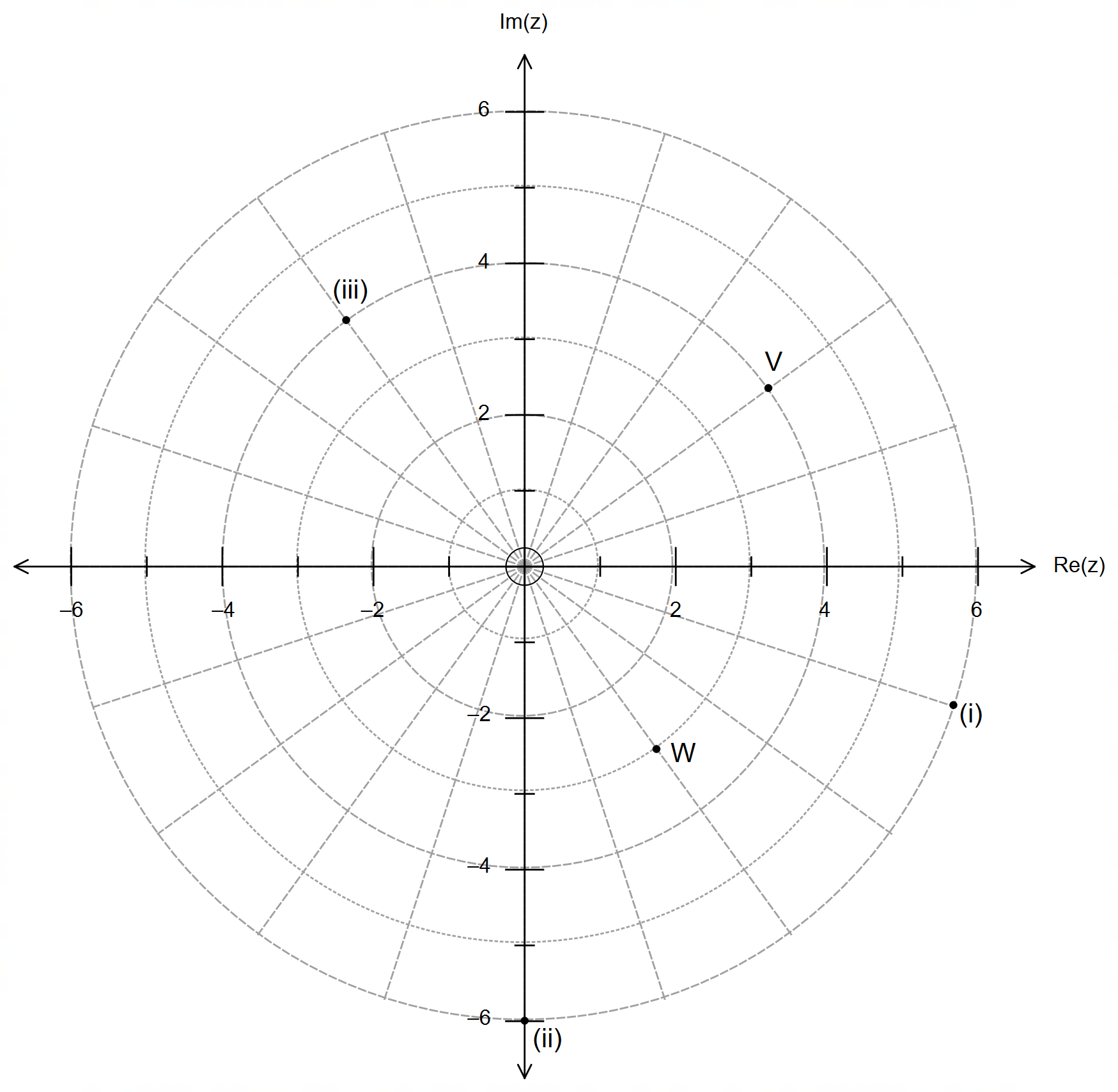
12. (a) and

(i) ✓✓

(ii)

✓✓

(iii) ✓✓



12. (b) (i) and occur along the line connecting the

centre of the circle with the origin.

and ✓✓

(ii) and

✓✓

✓✓ [12]

13. (a) Speed m/s ✓

✓

✓

(b)

✓

✓

Distance m ✓

(c) ✓

✓

m/s ✓

at m above level ground. ✓

(d) distance , ✓✓ [12]

14. (a) ✓✓

(b) ✓

✓

(c) and ✓✓

(d)

✓

✓

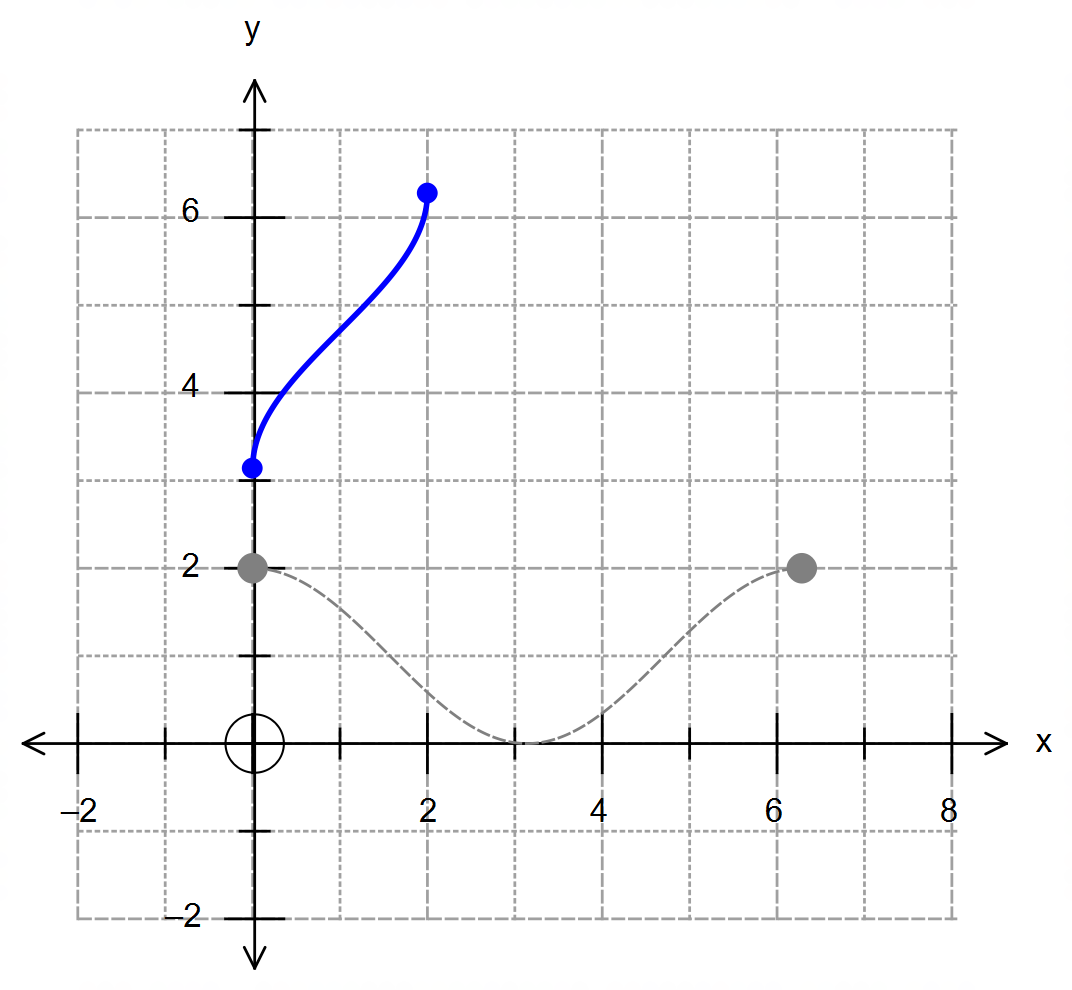
✓ [9]

15. (a) does not exist because is not a one-to-one function.✓

(b) (i) Need , hence ✓

Then, ✓✓

(ii) Domain and Range ✓✓

 (c)

✓ sinusoidal and symmetrical over the line y=x

✓ correct location and boundaries (accuracy)

(d)

✓✓ [10

16. ✓

✓

Similarly,

✓

and , and for domain to remain the same:

✓

Hence, ✓ [5]

(Other methods are possible depending on their choice of trigonometric

identity. Award marks accordingly).