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**MATHEMATICS**

**SPECIALIST**

**UNIT 3**

**Semester One**

**2017**

**SOLUTIONS**

***Calculator−free Solutions***

1. (a) ✓

✓

as required

(b) ✓

Using factorisation:

✓

✓

✓

OR using division of polynomials:

✓✓

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
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|  |  |  |  |  |
|  |  |  |  |  |

✓ [6]

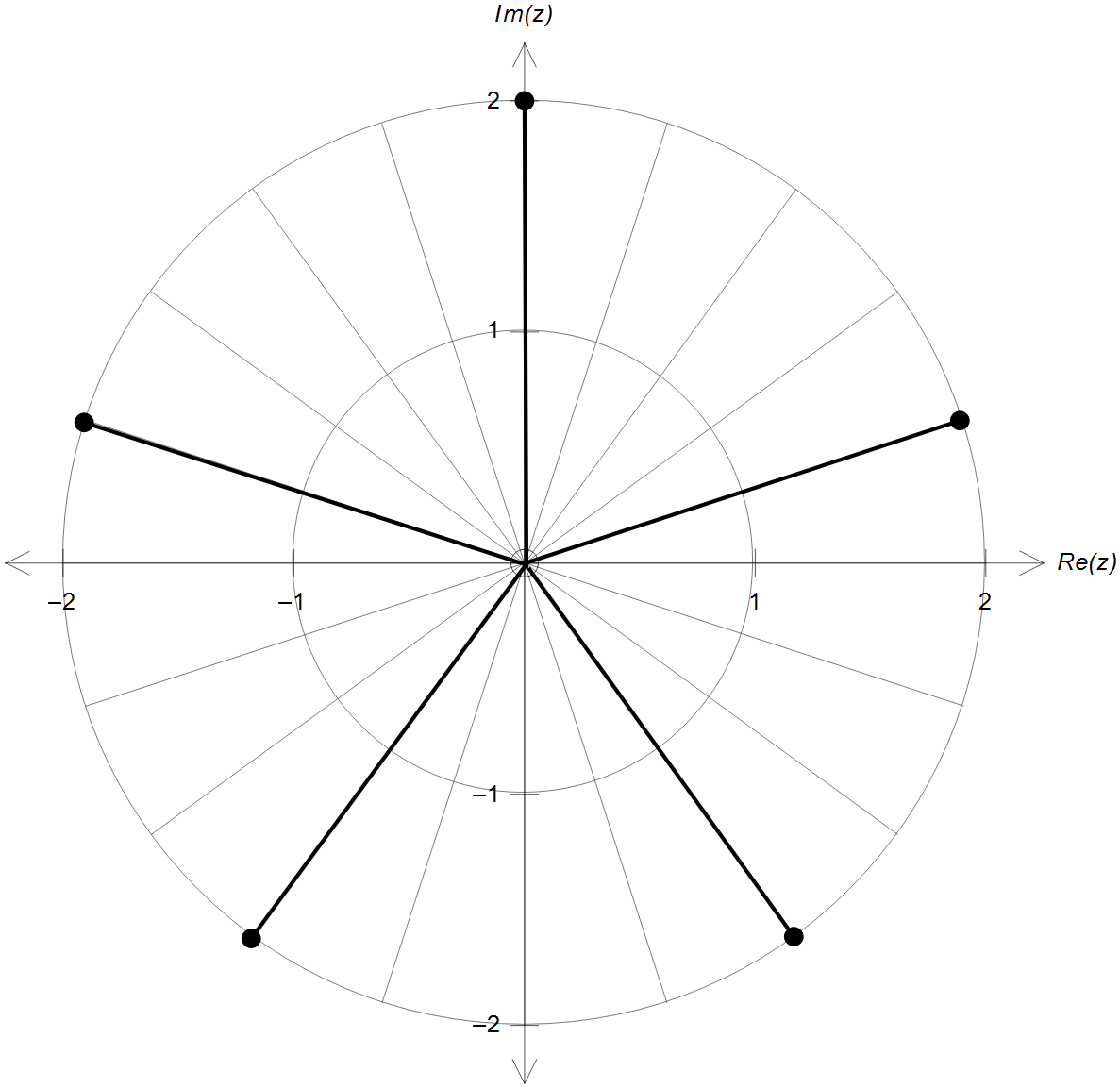
2. (a)

with ✓

with ✓

hence,

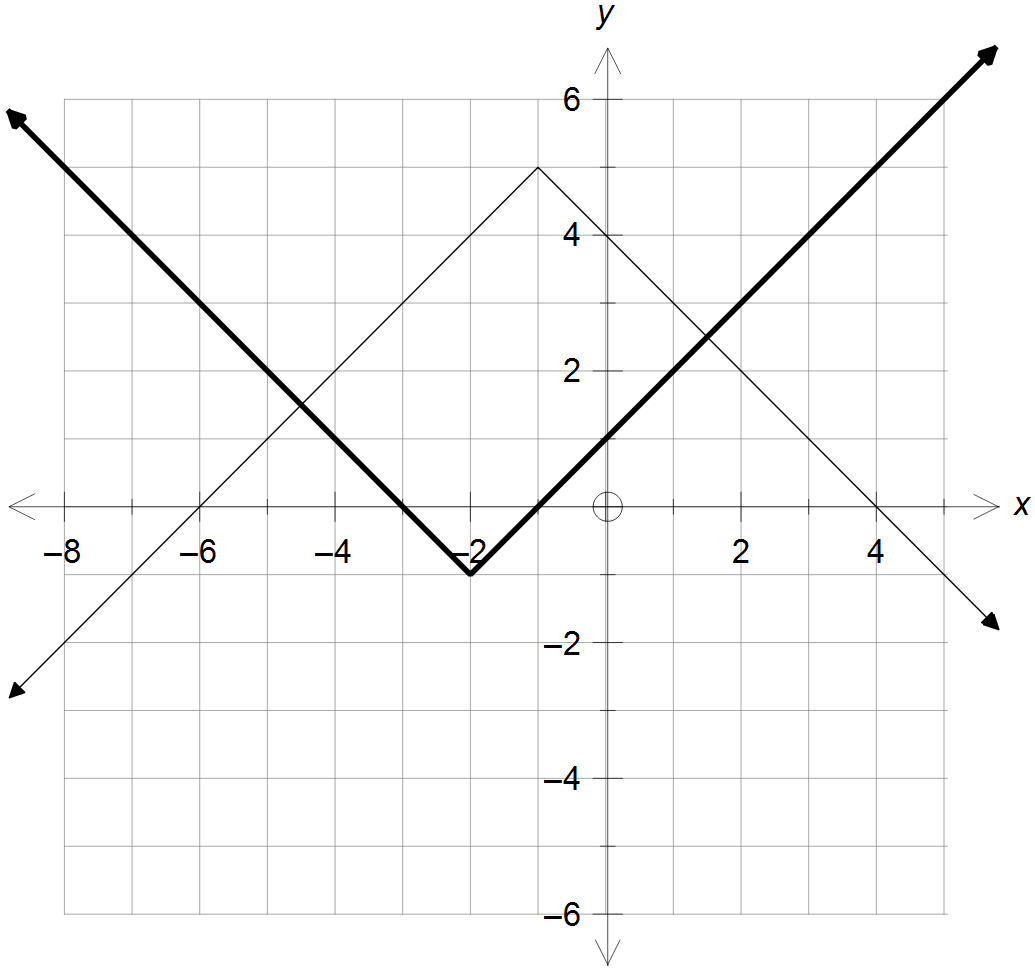
✓✓

2. (b)

✓ magnitude = 2

✓ radians apart

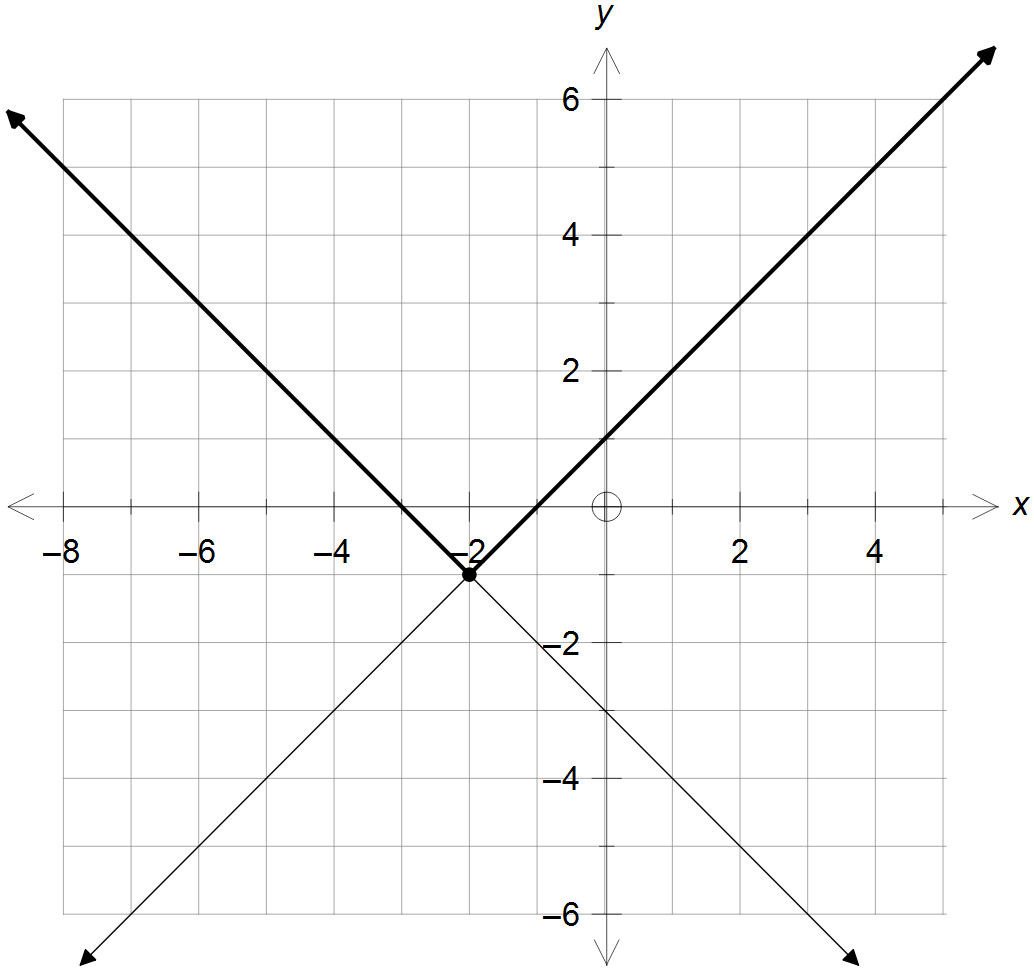
[6]



3. (a)

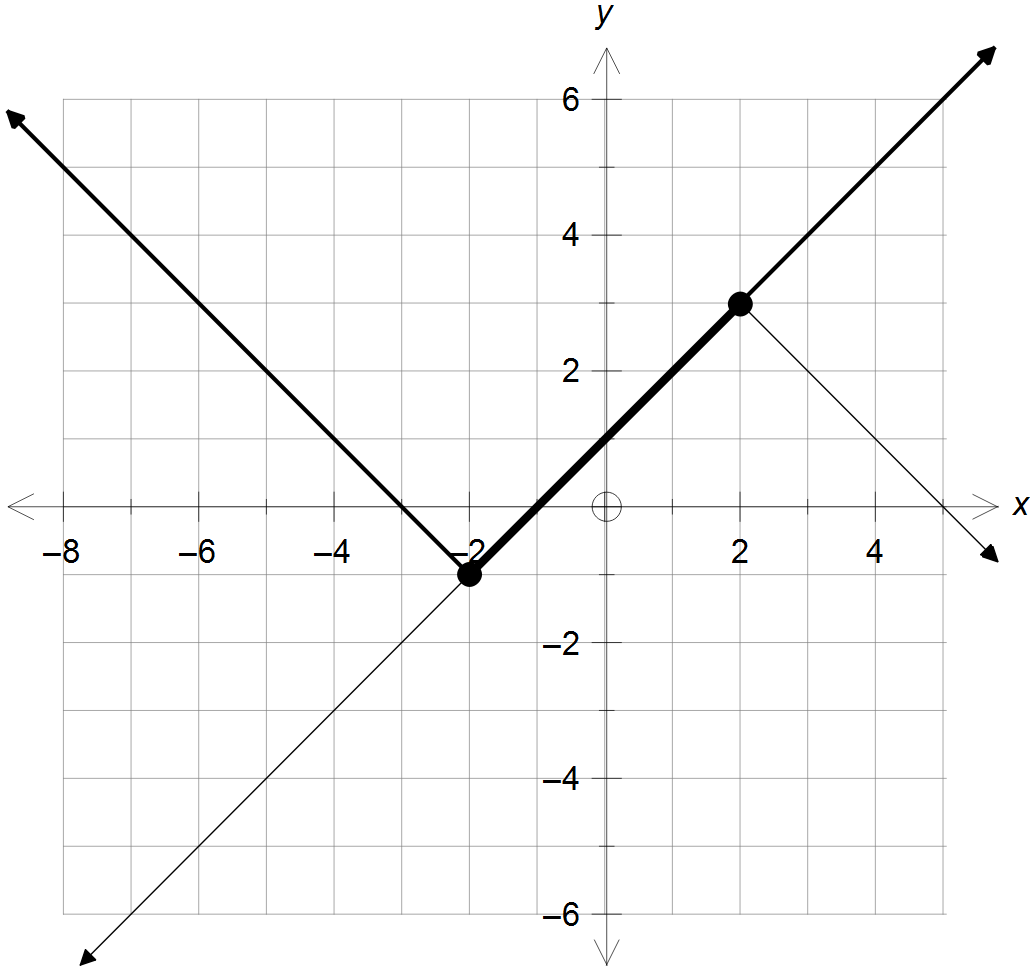
✓ correct x position

✓ correct y position



(b) (i)

and ✓✓

3. (b) (ii)

and ✓✓ [2]

4. (a) with

✓

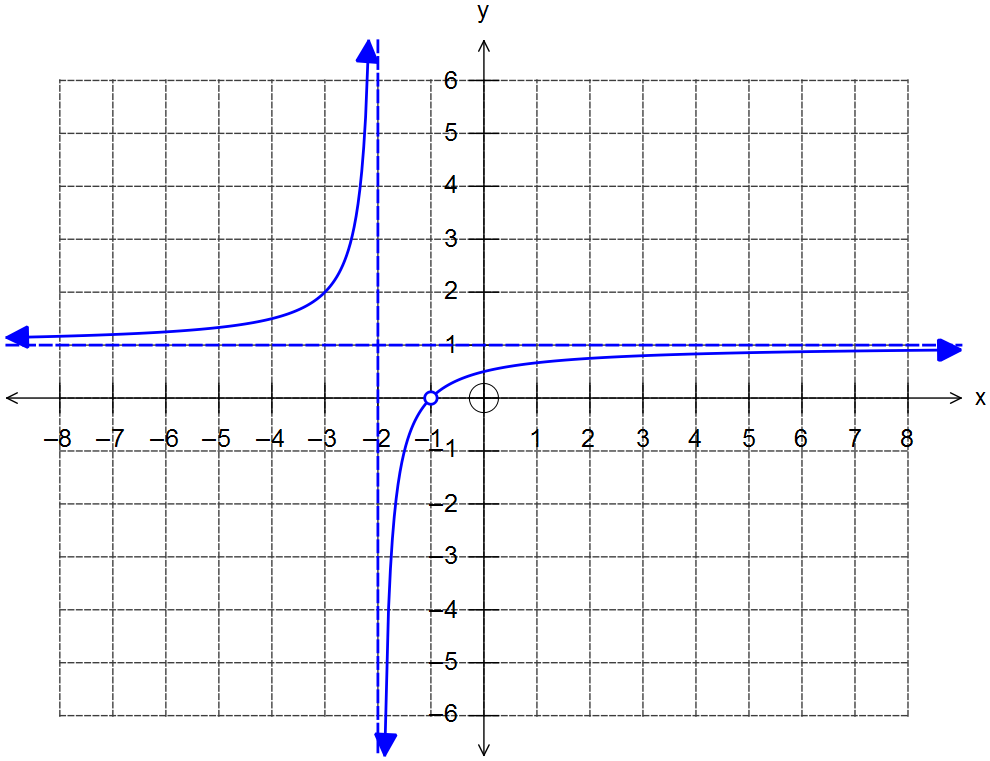
and ✓✓

on its natural domain, hence ✓

will not be generated by the second

✓

(b)

 ✓

✓ asymptotes

x = -2 and y = 1

✓ discontinuity at

x = -1

✓ correct shape

4. (c)

✓

Domain ✓

Range ✓ [12]

5. (a) Cartesian equations of the planes:

Using matrices:

✓

✓

,

,

,

Unique solution: ✓

(b) Fully simplified matrix in terms of :

✓

✓

✓ [6]

(Algebraic manipulation and substitution is also acceptable)

6. (a) Midpoint between and is ✓✓

OR , centre = ✓✓

radius = units ✓

✓

(b)

✓✓

✓

✓ [8]

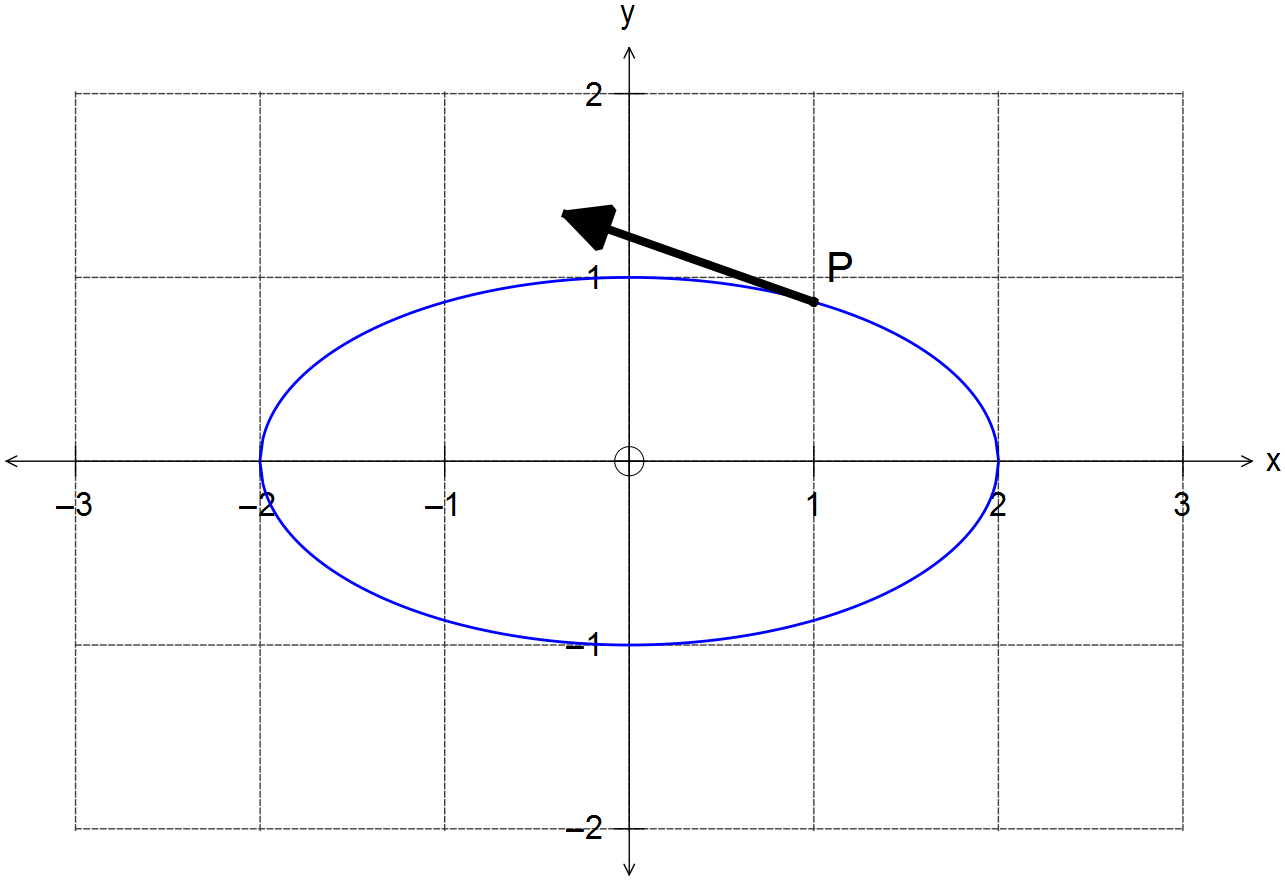
7. (a)

✓✓

(b) ✓

✓

✓



✓ [6]

***Calculator−Assumed Solutions***

8. (a) and ✓✓

(b)

✓

✓

✓✓ [6]

9. (a) ✓

✓

✓

✓

(b) Condition to stop:

✓

for *x* axis and for *y* axis ✓

Since there is no unique solution, the particle does

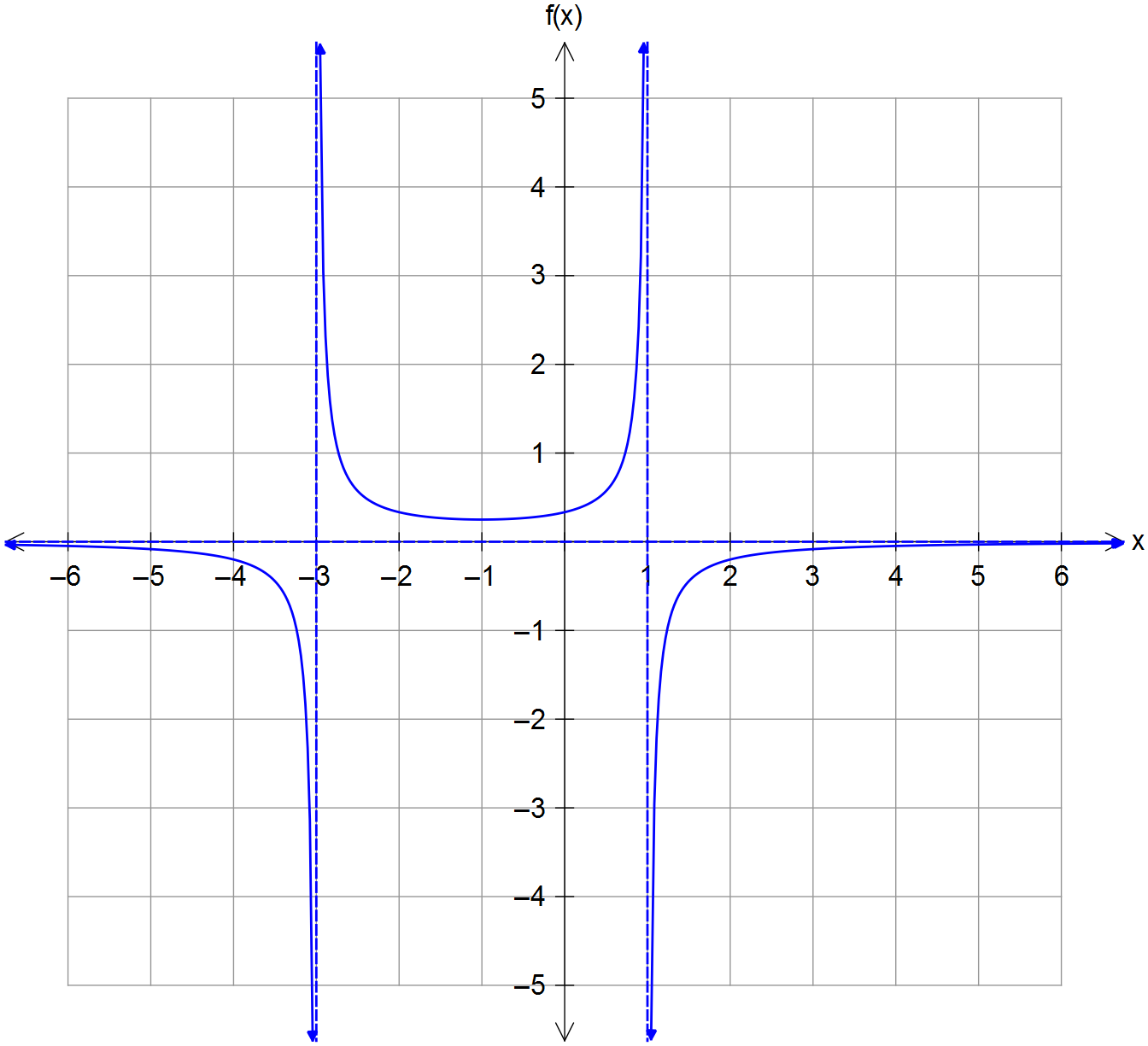
not come to a stop. ✓

(c) Motion parallel to *x* axis = no *y* axis velocity

seconds ✓✓

ms-1 ✓

✓ [11]

10. (a)

✓ Vertical asymptotes

x = -3, x = 1

✓ Indicates y → 0-

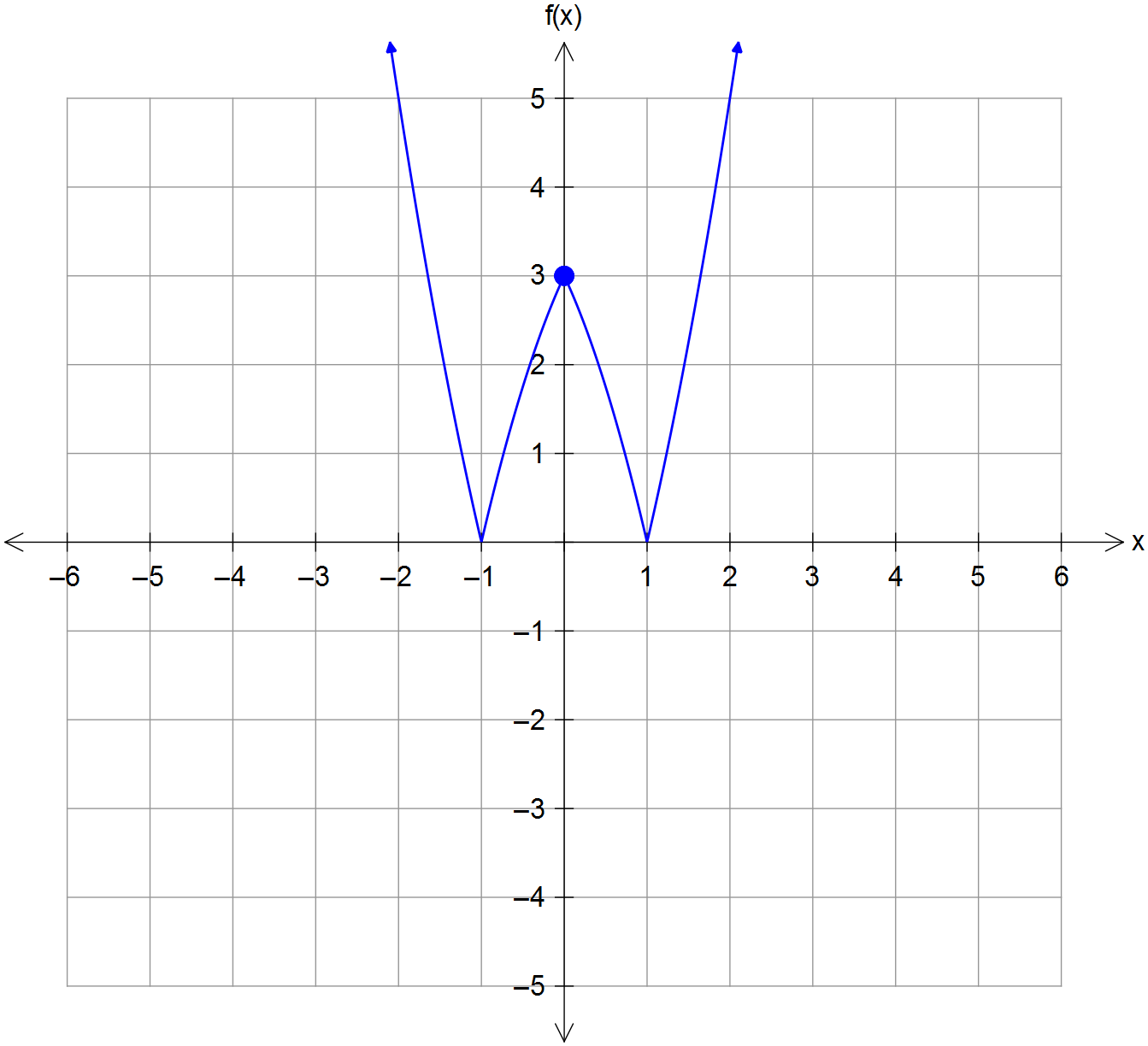
as |x| → ∞

✓ Shows local min

at x = -1

✓ Correct curvature at

x = -3 and x = 1

 (b)

✓ Correct mirror image

over x axis

✓ Correct mirror image

over y axis

✓ Indicates points

(0,3),(-1,0) and (1,0)

(c) Function can be inverted about its turning point.

i.e., for ✓

Domain ✓

Range ✓ [10]

11. (a) At the xz plane y = 0. ✓

✓

circle centred at and radius units ✓✓

(b) Completing the squares of the original sphere:

✓

centre of sphere is

✓

✓

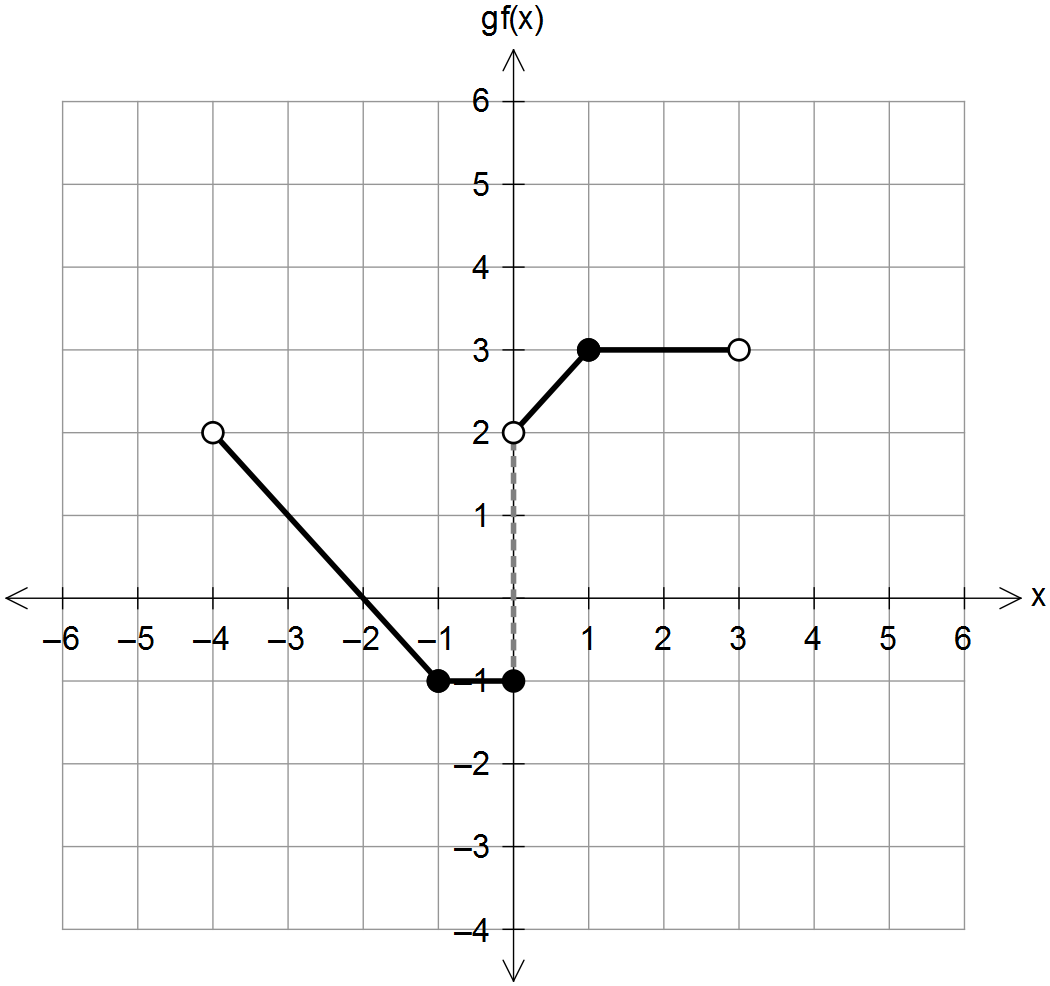
and hence ✓ [8]

12. (a)

✓✓✓

(b) (i) ✓

✓



(ii)

✓ correct sections

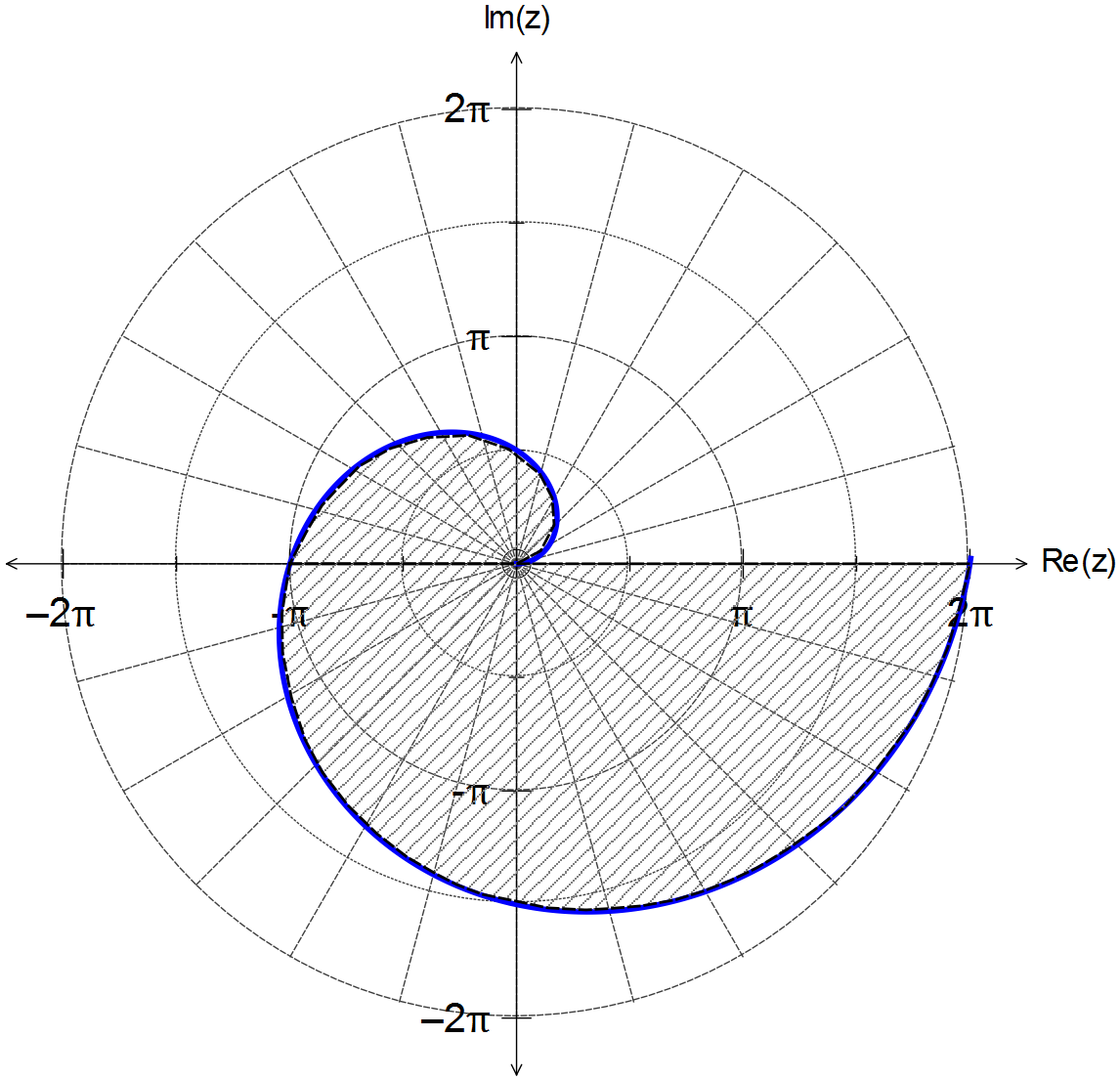
✓ correct y-intersect

✓ correct discontinuities

[8]

13. (a) ✓✓✓

(b) region under spiral



✓ spiral r = θ

✓ region under spiral

and x axis

(b) such that

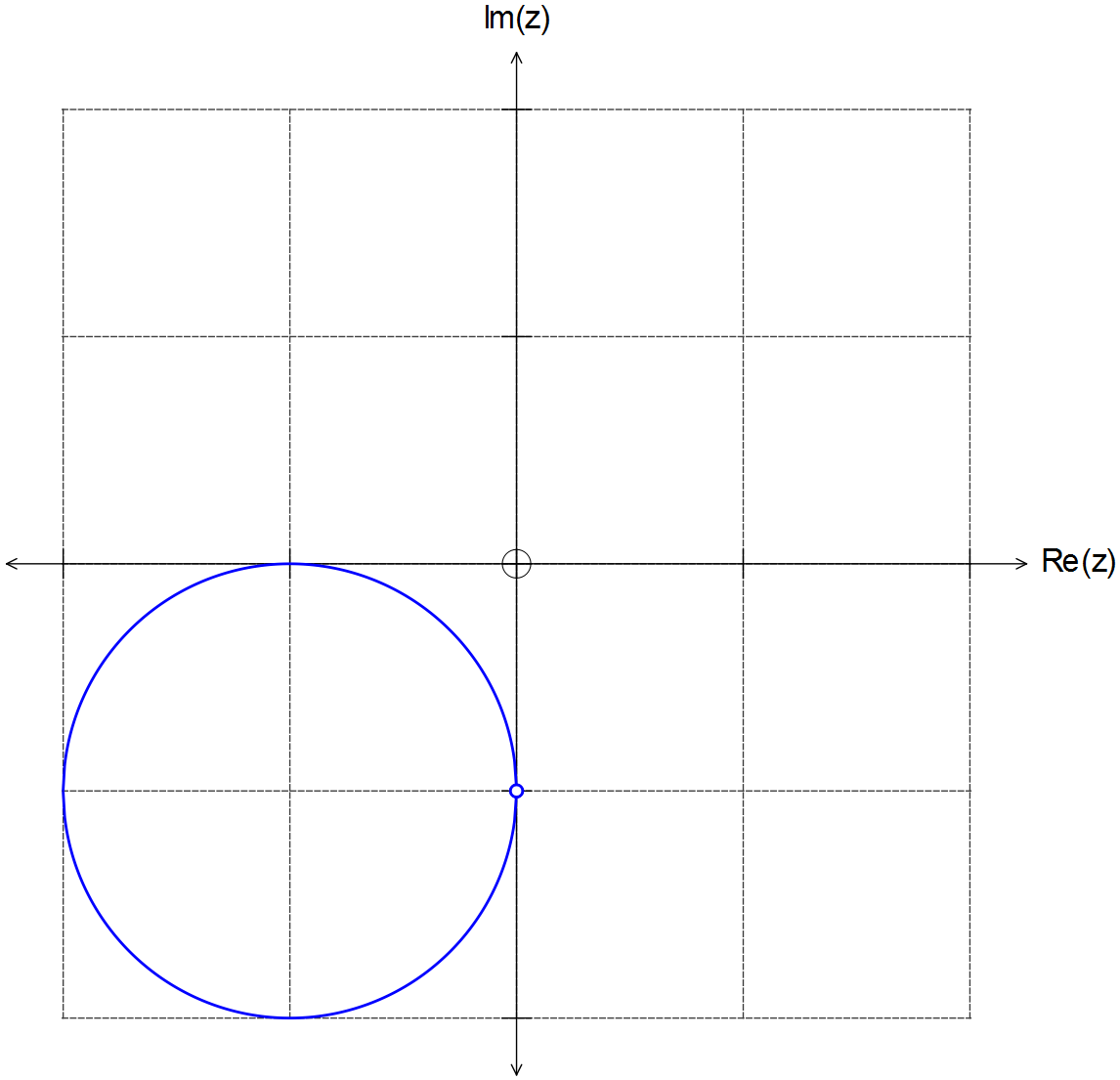
CAS: ✓

✓

✓

circle centred at and radius ✓

with discontinuity at ✓



[10]

14. (a) height = vertical velocity × time = 90 × 4 = 360 m ✓

(b) Detonation at ✓

✓

direct distance = m ✓

time difference seconds ✓

(c) speed ms-1 ✓

projection vector onto xy plane ✓

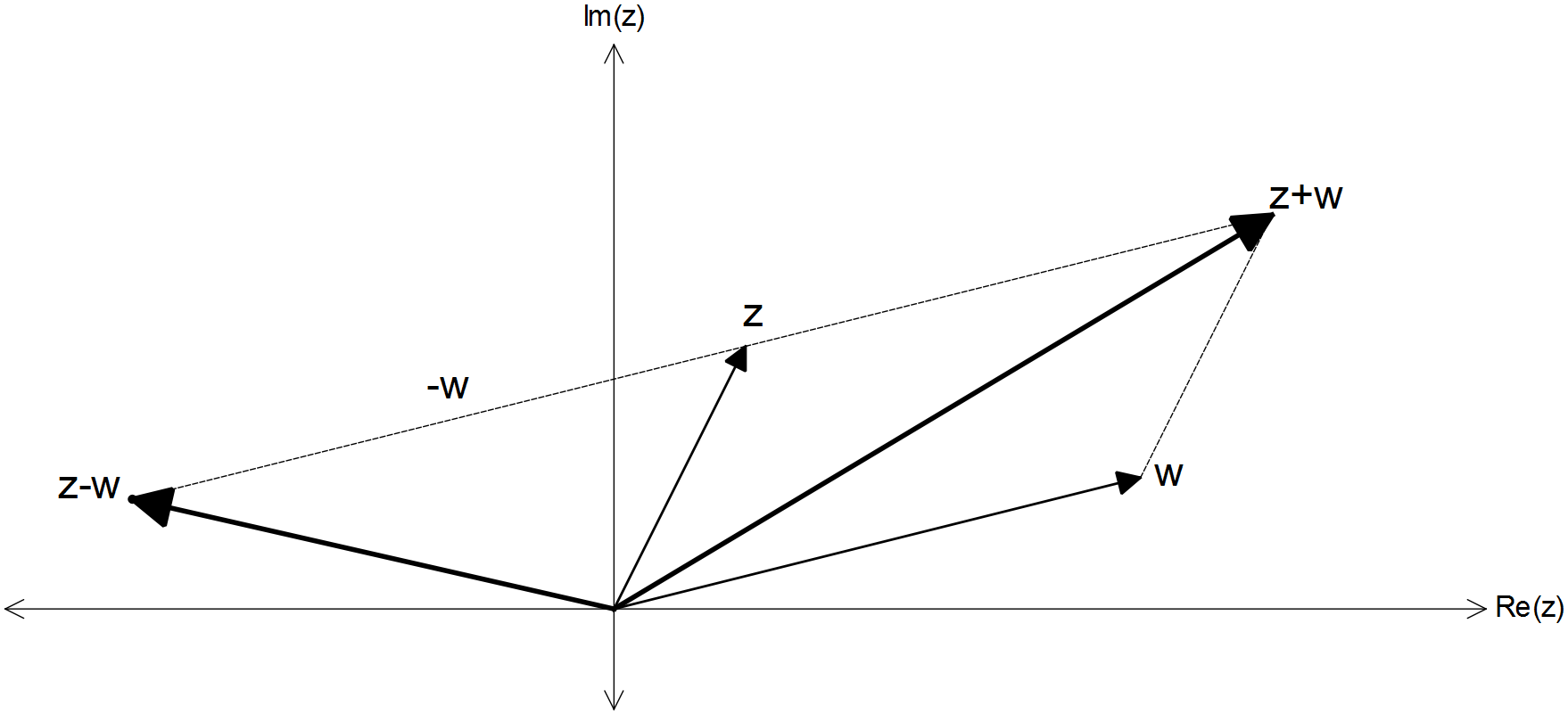
✓

✓

(d) distance vector ✓

velocity ms-1 ✓ [11]

15. (a) (i)



✓ z + w

✓ z – w in the

correct location

15. (a) (ii)

✓

✓

and hence ✓

if are treated as vectors, then ✓

and hence

(b) Let

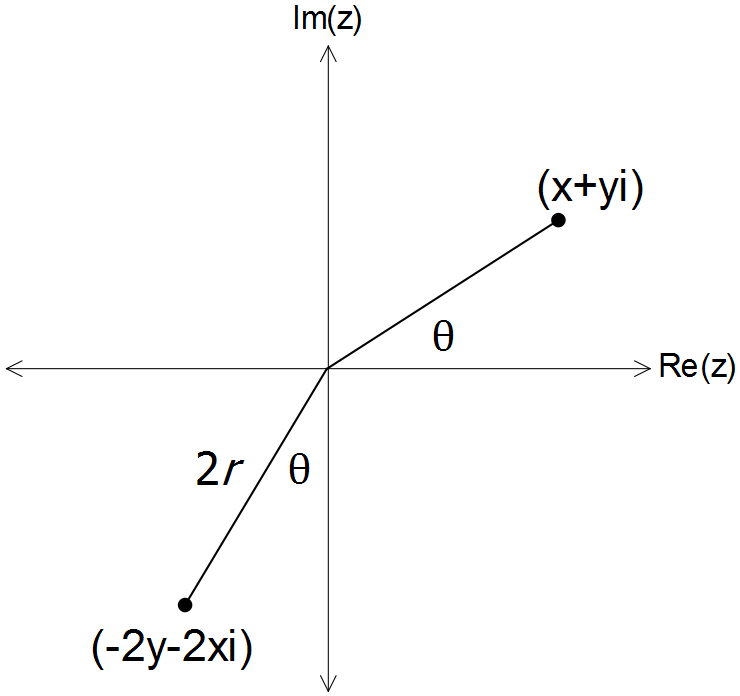
✓

✓

✓✓

(c) (i)

and ✓✓



(ii)

✓

✓ [14]

16. (a) CAS ✓✓

(OR, using division of polynomials)

(b)

✓✓✓

✓✓ [7]

17. (a) By De Moivre’s theorem

✓

✓

✓

✓

✓

(b) Let , then ✓

when ✓

and

✓ [8]

18. (a) If the dot product is zero, then is perpendicular to

the plane normal to and . ✓✓

If the cross product is zero, then and are parallel ✓✓

(b) LHS

✓

✓

✓

RHS [7]