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**SEMESTER TWO**

**MATHEMATICS**

**SPECIALIST**

**UNITS 3 & 4**

**2020**

**SOLUTIONS**

**Calculator−Free Solutions**

1. ✓

✓

2. has real coefficients ⇒ is also a solution. ✓

is a factor of ✓

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
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✓✓

Solutions are ✓ [5]

3. ✓

✓

✓

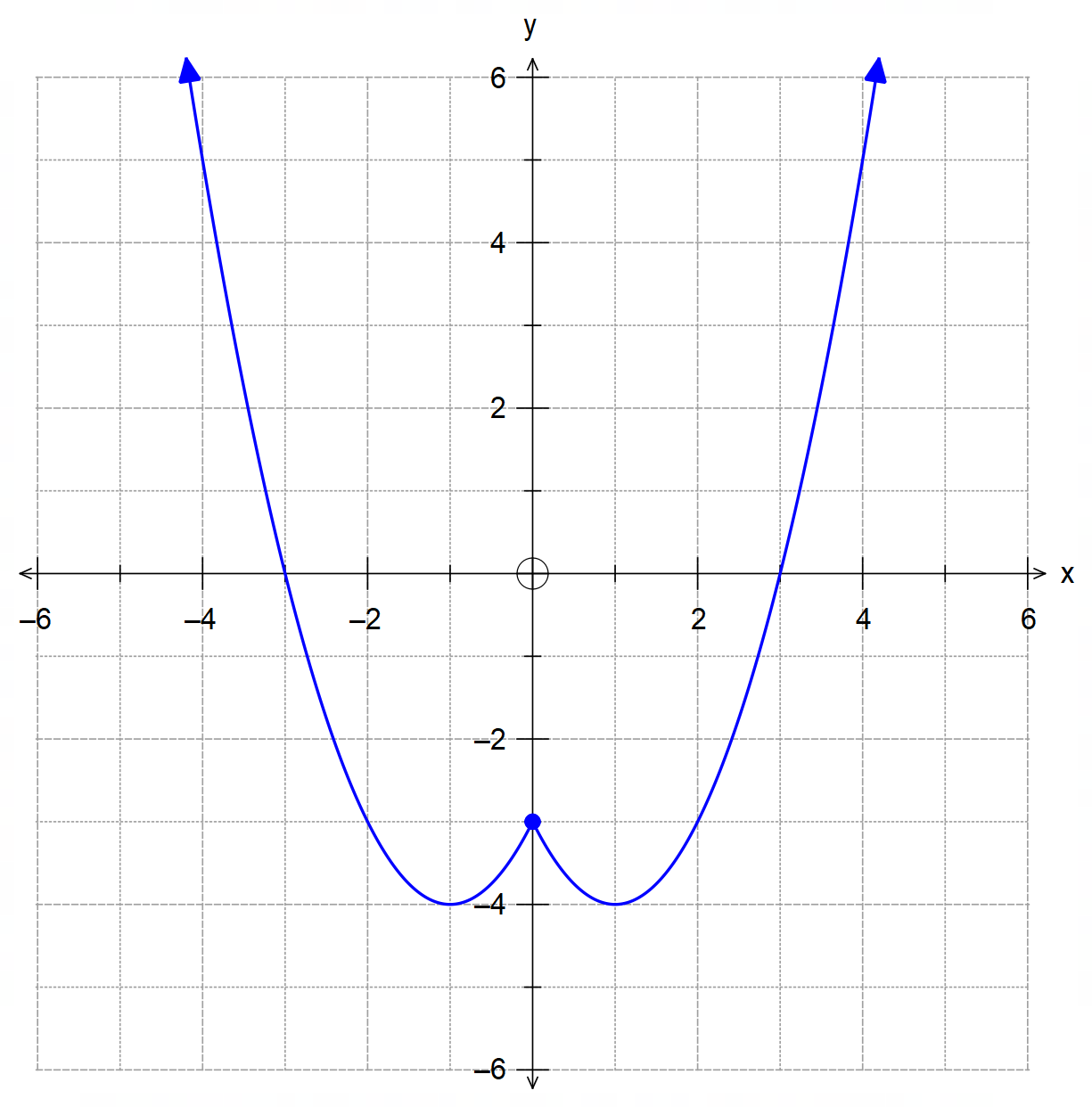
as required ✓ [5]

4. (a) ✓

For

which has a turning point at

and ✓✓

 (b)

✓

Parabolic shape

✓

Mirror image over the y-axis

✓

Local min at , and roots at

(c) has its turning point at , ✓

✓

(d) (i) ✓

(ii) ✓ [10]

5. (a) R is a solid sphere centred at with radius 3 units. ✓✓

units ✓

(b) xz plane therefore the intersection is given by

✓

circle centred at and radius units. ✓

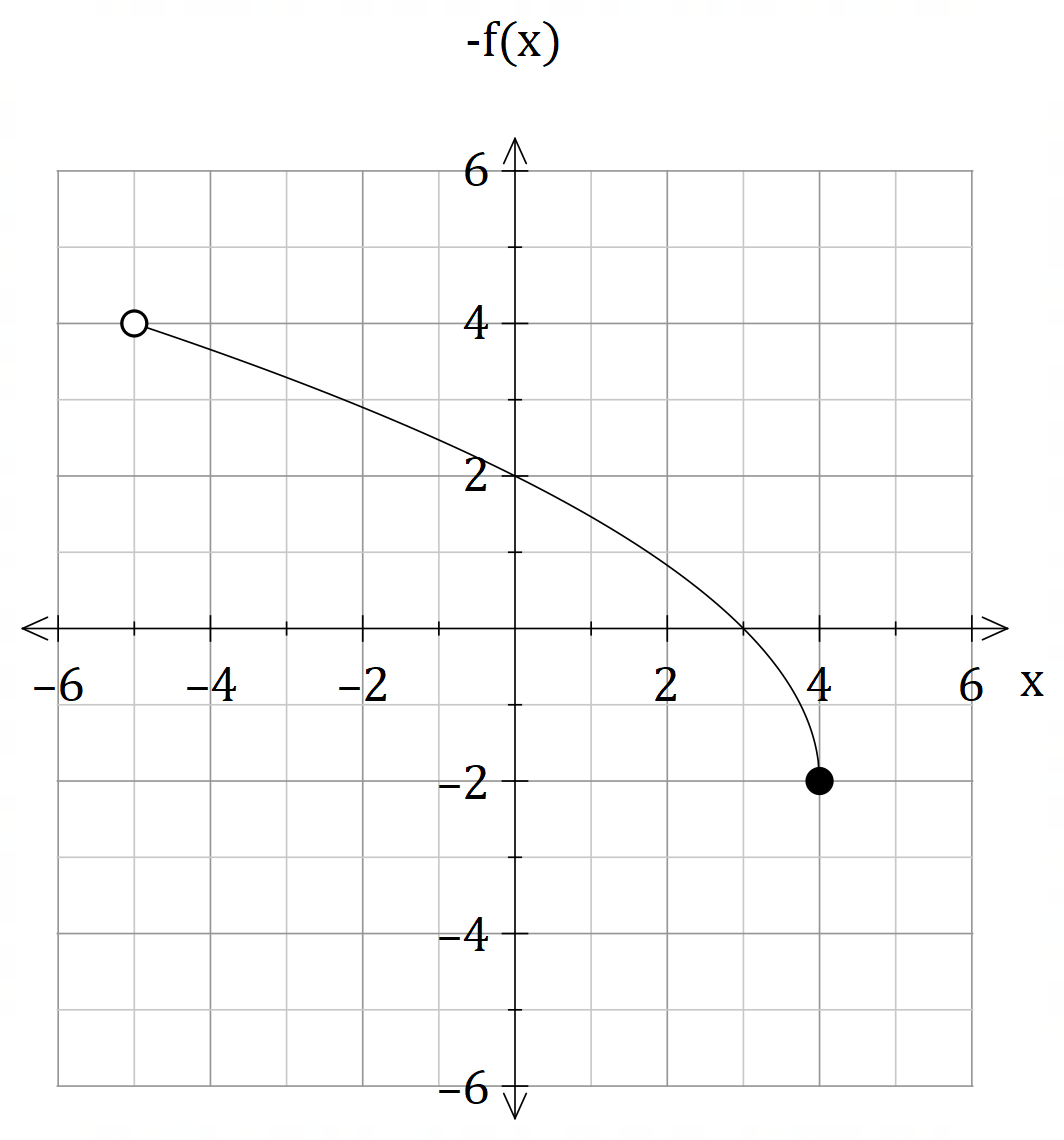
5. (c) The line is given by , hence:

✓

✓

Unique solution implies the line is tangent to the sphere R ✓

Point of tangency is . ✓ [9]

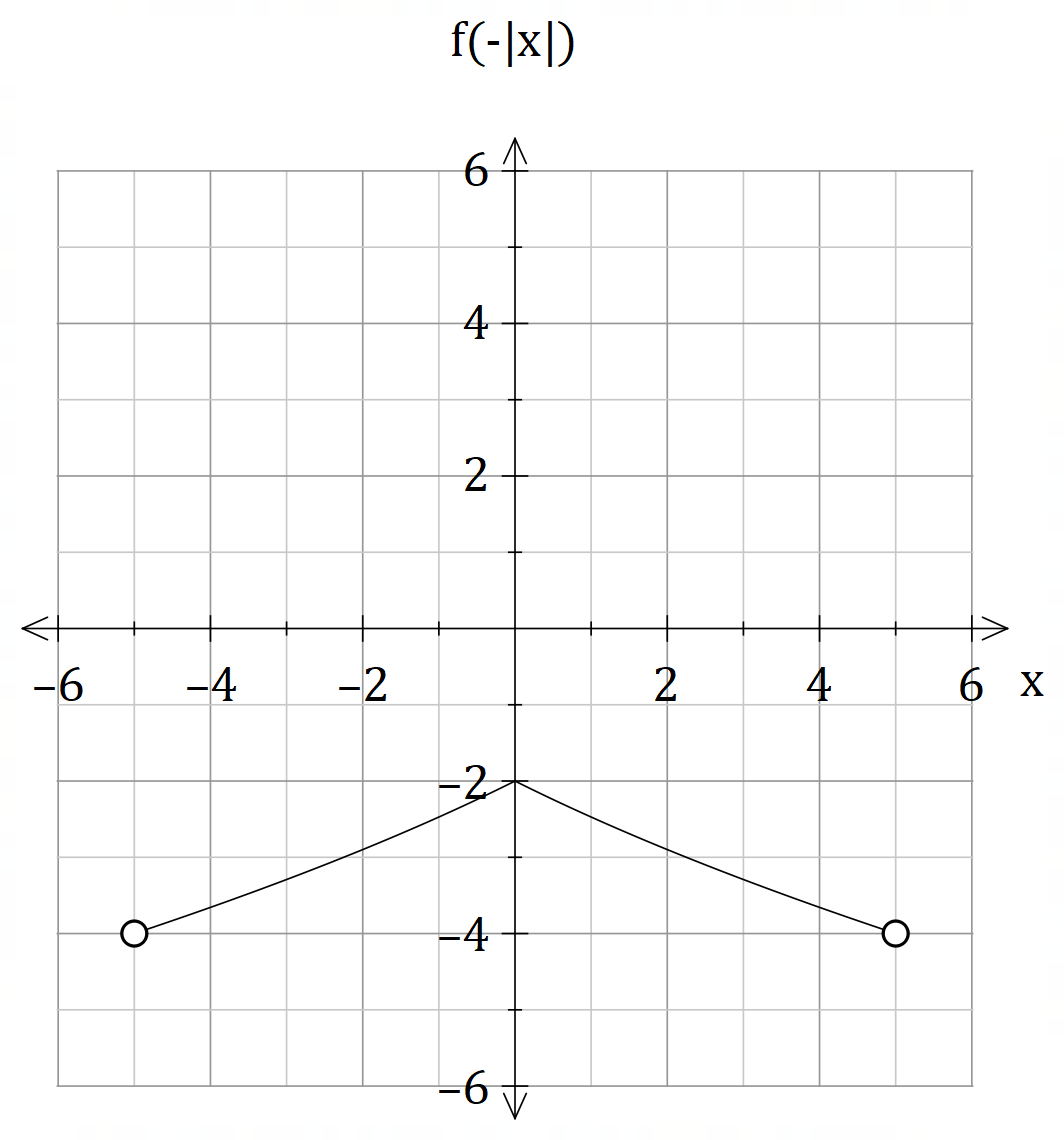
**6. (a)

✓

Square root function with correct orientation, root at and y-intercept at

✓

Open boundary at closed boundary at

**

✓

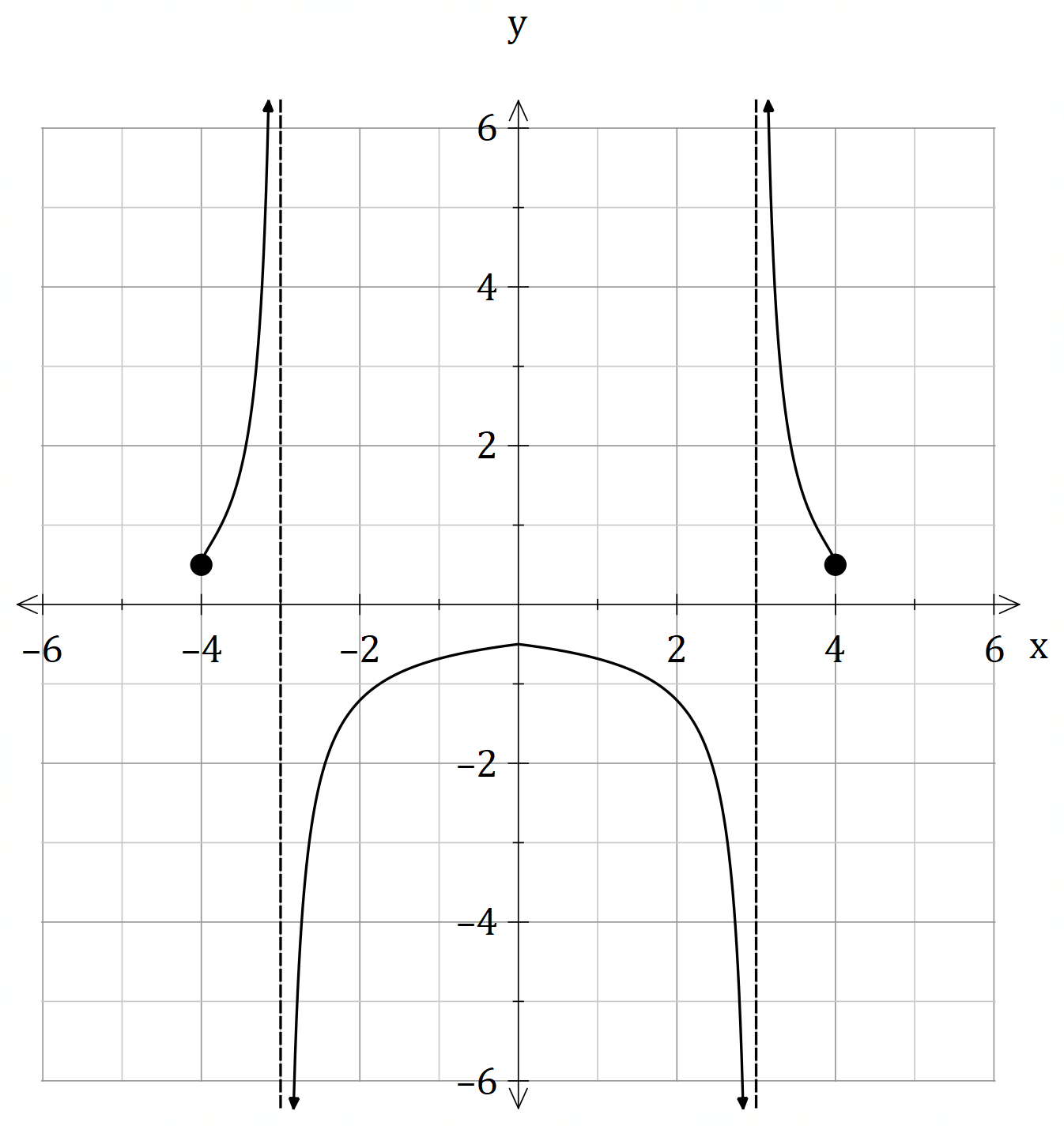
Mirror image over the

y-axis, completely below the x-axis

✓

y-intercept at ,

open boundaries at .

6. (b)

✓

Poles at

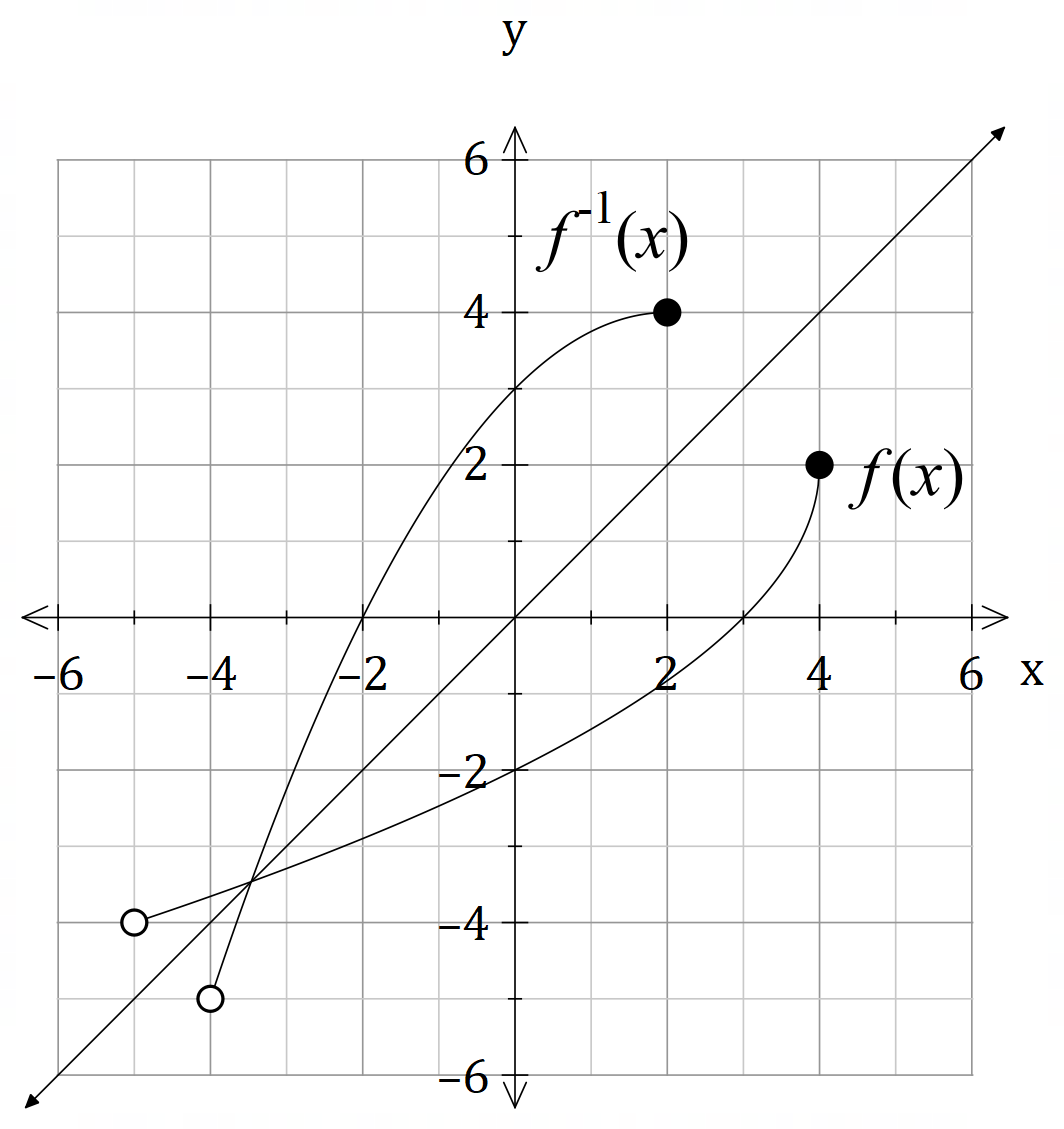
✓

Closed boundaries at

Y-intercept at

✓

Behaviour on either side of both poles

 (c) and are shown below, hence, for :

✓

✓

[9]

7. (a) (i) The internal parabolic outline is given by

Hence, the volume is given by:

as required

7. (a) (ii)

cm3 ✓

(b) V = Vcurved side + Vbase

= (Voutter shell – Vinner shell ) + Vbase

[7]

8. (a)

as required ✓

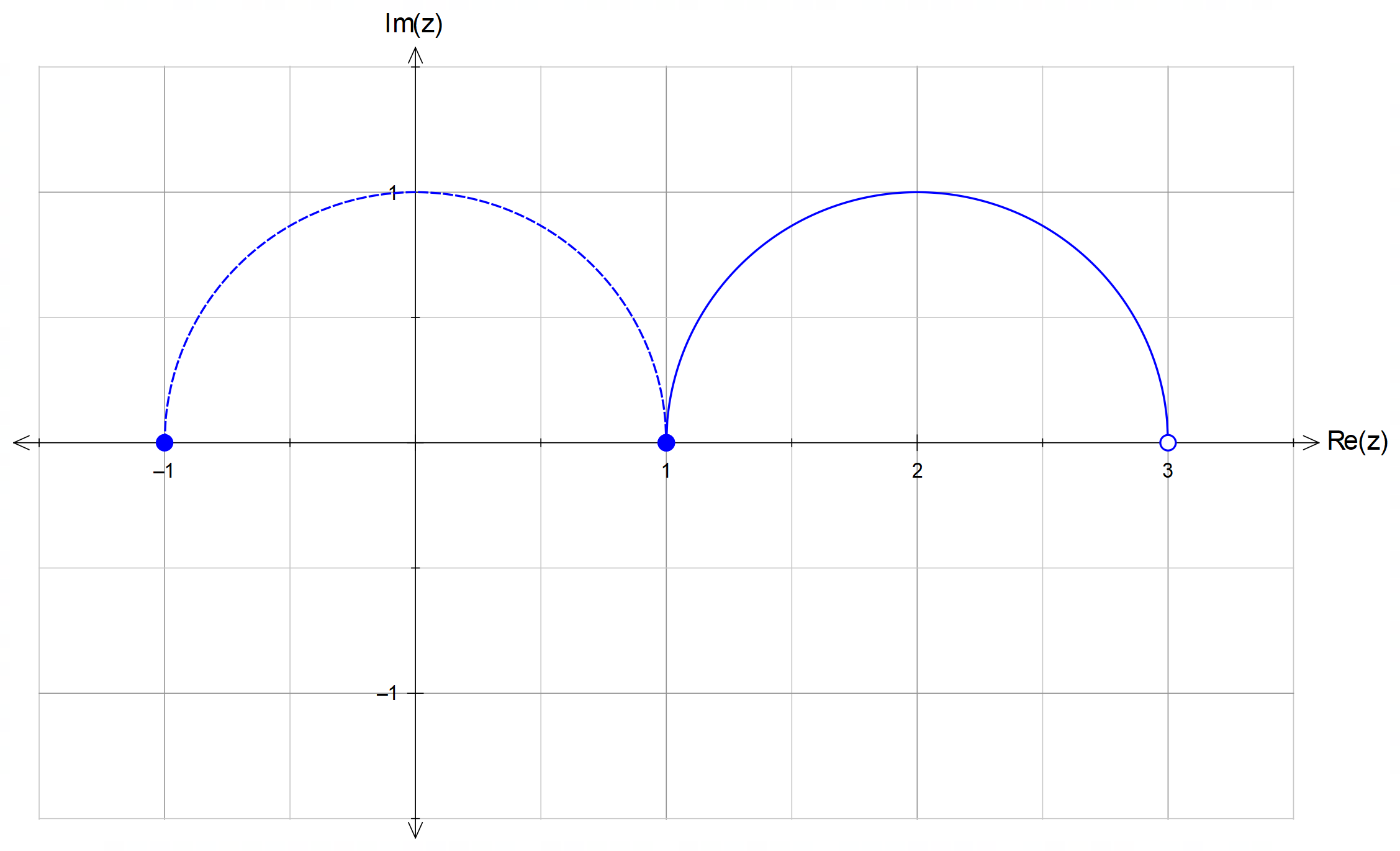
(b)

✓✓

✓ [4]

**Calculator−assumed Solutions**

9. (a)



✓

Semicircle

✓

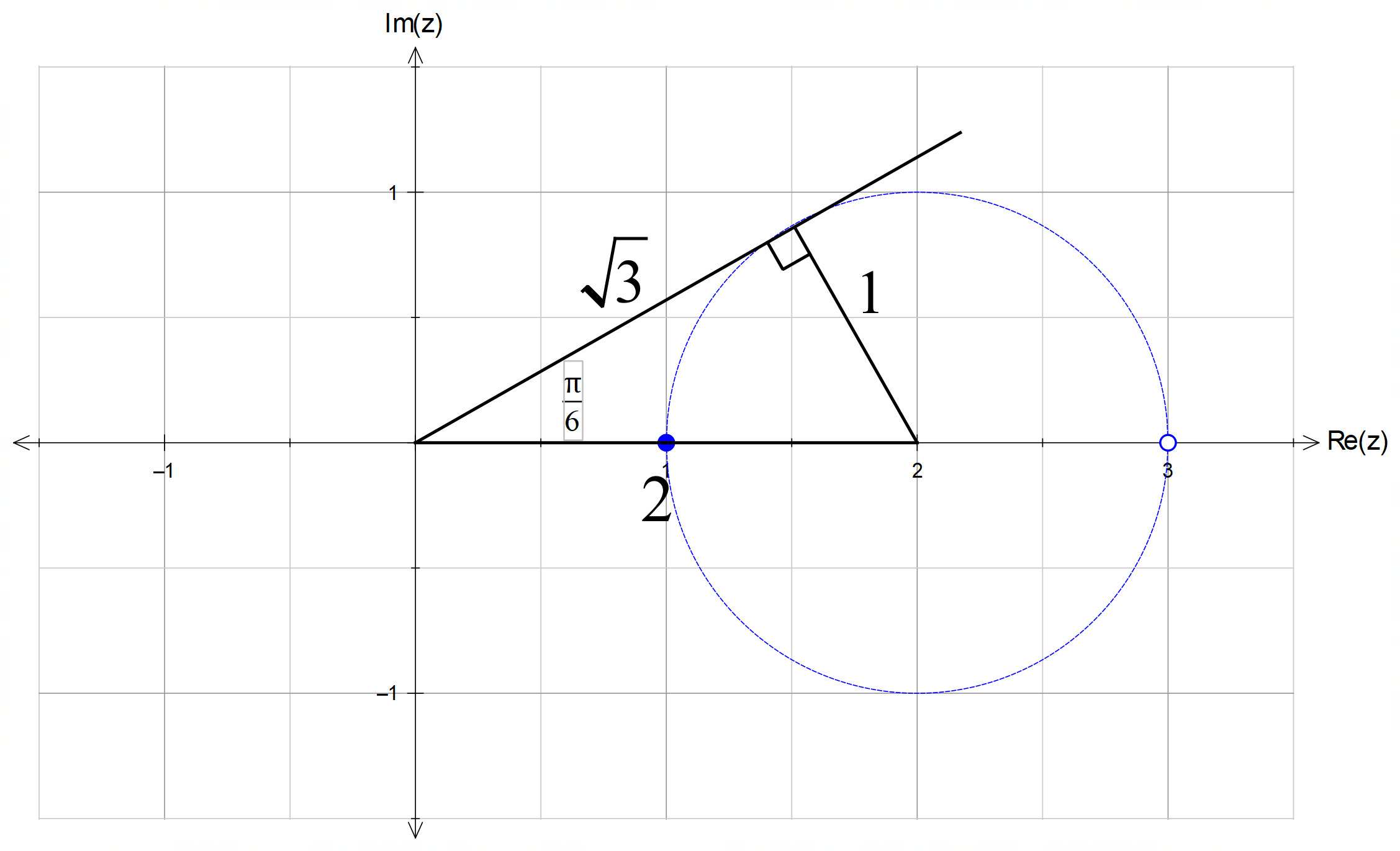
Centred at (2,0) and radius 1

✓

Discontinuous at

(or for FT marks if drawn on LHS)

(b)



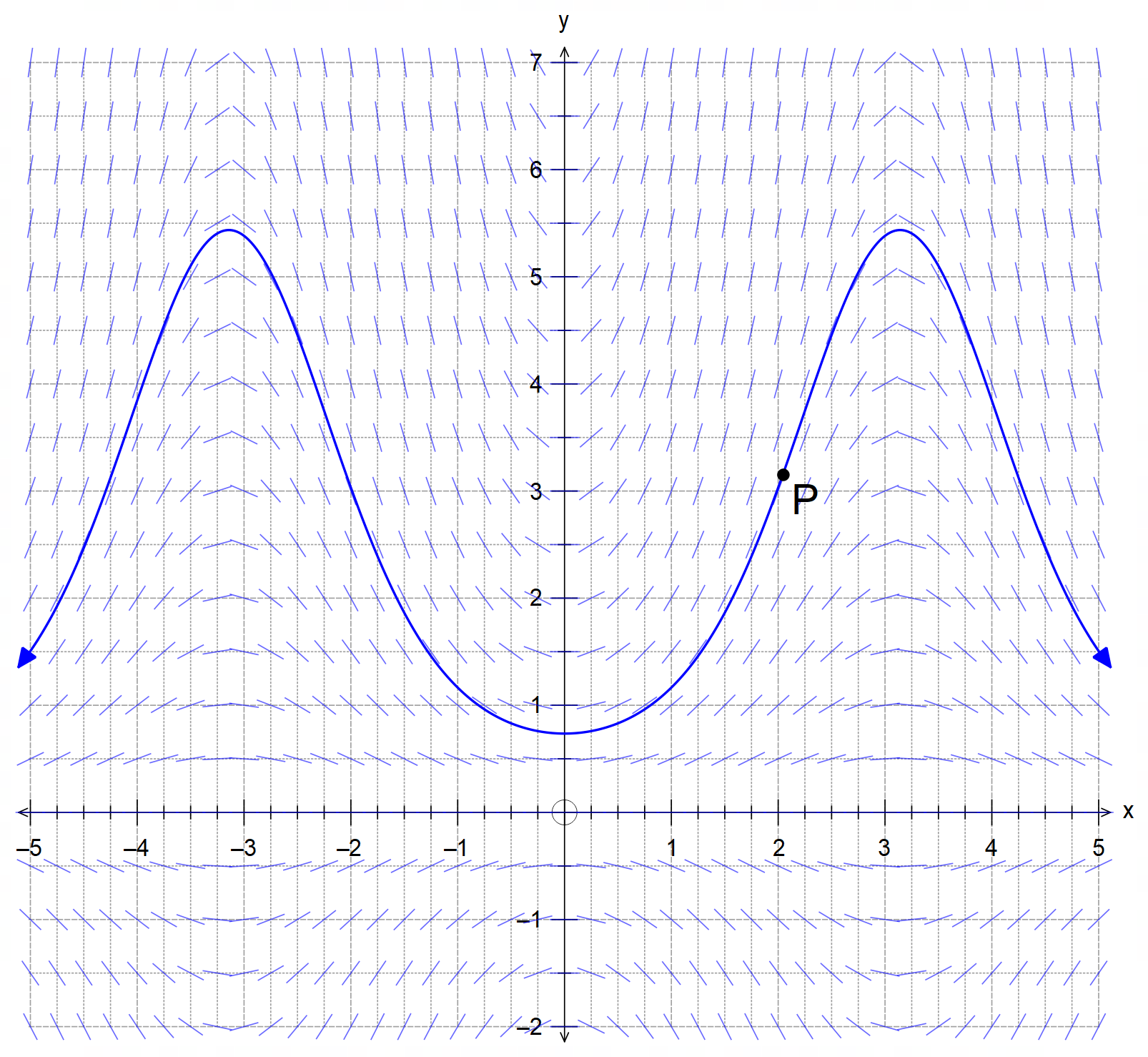
From diagram, and ✓✓

OR

and for follow through marks

if the circle is drawn on the LHS of the y-axis. [5]

10. (a) ✓



(b)

✓

Follows the isoclines to show a cyclic curve

(must be wider along the y-axis, it cannot look like a sinusoid)

✓

Passes through the point P

(c)

✓

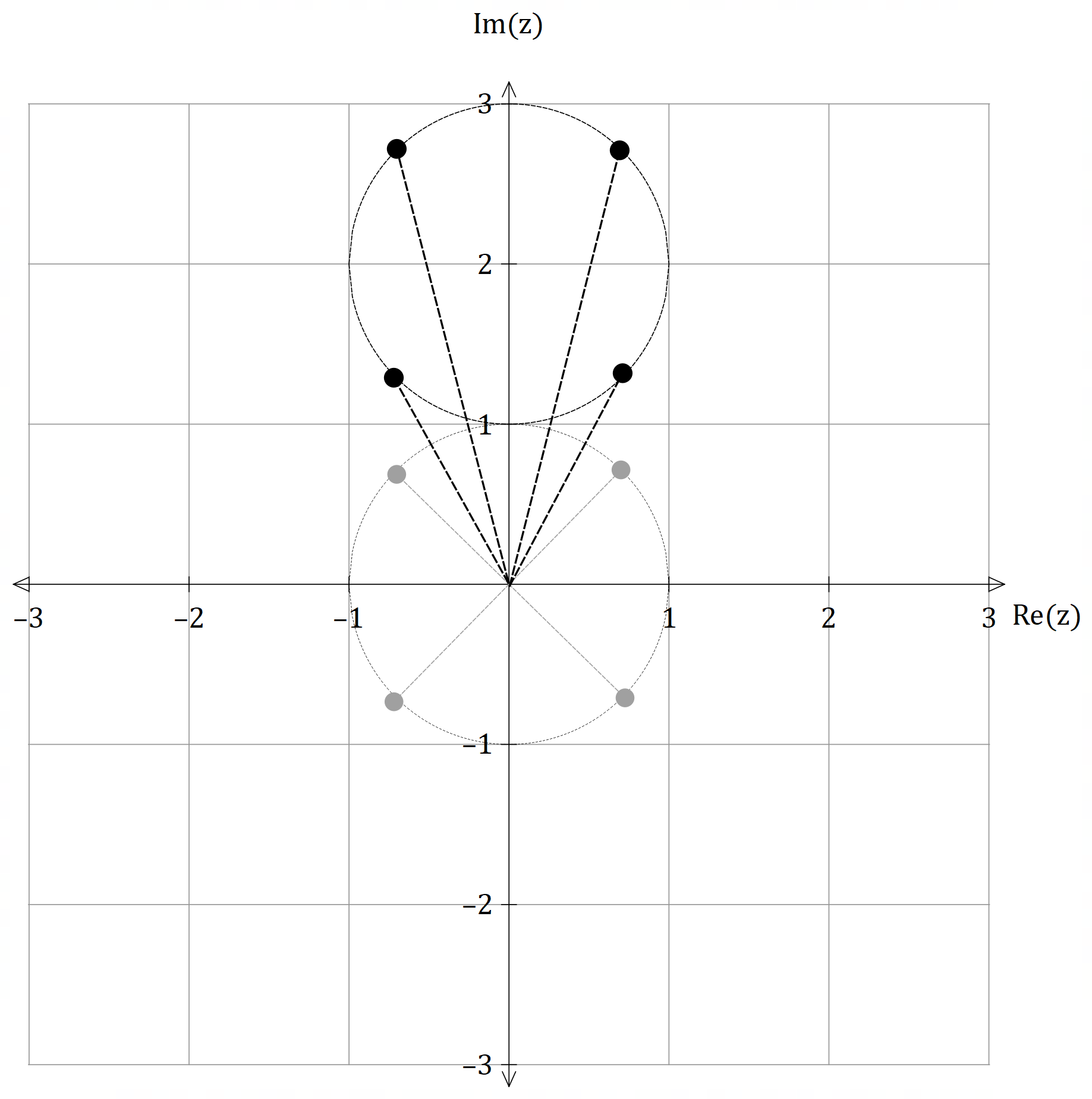
✓ [7]

11. (a) (i) ✓

✓

✓✓

11. (a) (ii) Solutions from (a)(i) move two units up:



✓

4 solutions equidistant from 2i

✓✓

equally spaced at radians from each other within the circle centred at

(b) (i)

✓✓

(or CAS)

(ii) ✓✓

✓

as required ✓ [13]

12. (a)

✓

✓

✓

(b) ✓

✓

✓

12. (c) for ✓

and ✓✓

(d) ✓✓✓ [12]

13. (a) is approximately a normal distribution by the

Central Limit Theorem since ✓

✓

with ✓

(b) ✓

✓

(c) Since ⇒

the answer in (b) would be lower/smaller ✓

because the lower standard deviation of the sample mean ✓

(d) Require

✓

✓

patients ✓ [10]

[Accept 6764 and 6765 depending on accuracy used]

14. (a) ✓

✓

✓✓

14. (b)

✓

later

✓

✓

m/s ✓ [8]

15. All coordinates in the first octant are positive. ✓

xy-plane intersection

not in the first octant ✓

xz-plane intersection

in the first octant ✓

yz-plane intersection

in the first octant ✓

✓✓ [6]

16. (a) ✓

(b) ✓

which is the carrying capacity of the system

16. (c)

✓

✓

✓✓

as required

(d) ✓✓ [8]

17. (a) 90% confidence interval for :

✓

✓

✓

(b) From July:

For August: ✓✓

(c) C is the most accurate. ✓

Because it is based on the smallest standart error ✓

(d) We do not know which interval, if any, ✓

because we cannot determine the true

value of the population mean. ✓ [9]

18. (a) ✓

✓

(b) Let ✓

✓

18. (c) Use :

and ✓

✓✓ [7]

19. (a) Outline of the circle in x/y plane given by:

✓

✓

✓

✓

✓

(b) Use :

as required. ✓

(c) :

as required ✓ [7]

20. ✓

✓✓

✓

as required ✓ [5]