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VCE Mathematical Methods ½
Polynomials [1.5]
Test Solutions

19 Marks. 20 Minutes Writing. 1 Minute Reading.

<u>Results</u>:

Test Questions	_____ / 19

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Section A: Test Questions (19 Marks)

Question 1 (4 marks)

Tick whether the following statements are **True** or **False**.

Statement	True	False
a. The minimum number of roots for a cubic is three.		✓
b. The root of a polynomial that has a factor of $x + 3$ is $x = 3$.		✓
c. If $f(1) = 2$, then $f(x) \div (3x - 6)$ has a remainder of 2.		✓
d. The remainder of $(x^3 + 3x^2 - x + 2) \div (x - 2)$ is 20.	✓	
e. To factorise a quartic, we generally need to find two roots by trial and error.	✓	
f. The rational root theorem suggests that $ax^3 + bx^2 + cx + d$ will have roots that are factors of d divided by the factors of a.	✓	
g. Graphs of polynomials where the highest degree is odd, both start and finish at either positive or negative infinity.		✓
h. All repeated roots correspond to turning points on the graph of a polynomial.		✓

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Question 2 (3 marks)

Consider the function $f(x) = x^3 + ax^2 + bx$. If $x - 1$ is a factor of $f(x)$ and the remainder of $f(x) \div (x + 4)$ is given by -20, find the value(s) of a and b.

```
f[x_] := x³ + a * x² + b * x

Solve[f[1] == 0 && f[-4] == -20, {a, b}]

{{a → 2, b → -3}}
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Question 3 (3 marks)

Solve the following equation for x.

$$2x^3 + 11x^2 = 12(x + 3)$$

$$\text{Solve}\left[2\,x^3 + 11\,x^2 == 12\,(x + 3)\right]$$

$$\left\{ \{x \to -6\},\ \left\{x \to -\frac{3}{2}\right\},\ \{x \to 2\} \right\}$$

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Question 4 (3 marks)

Sketch the graph of the following function on the axes below. Label all axes intercepts with their coordinates.

$$y = (x - 2)^2(x - 3)(x + 1)$$
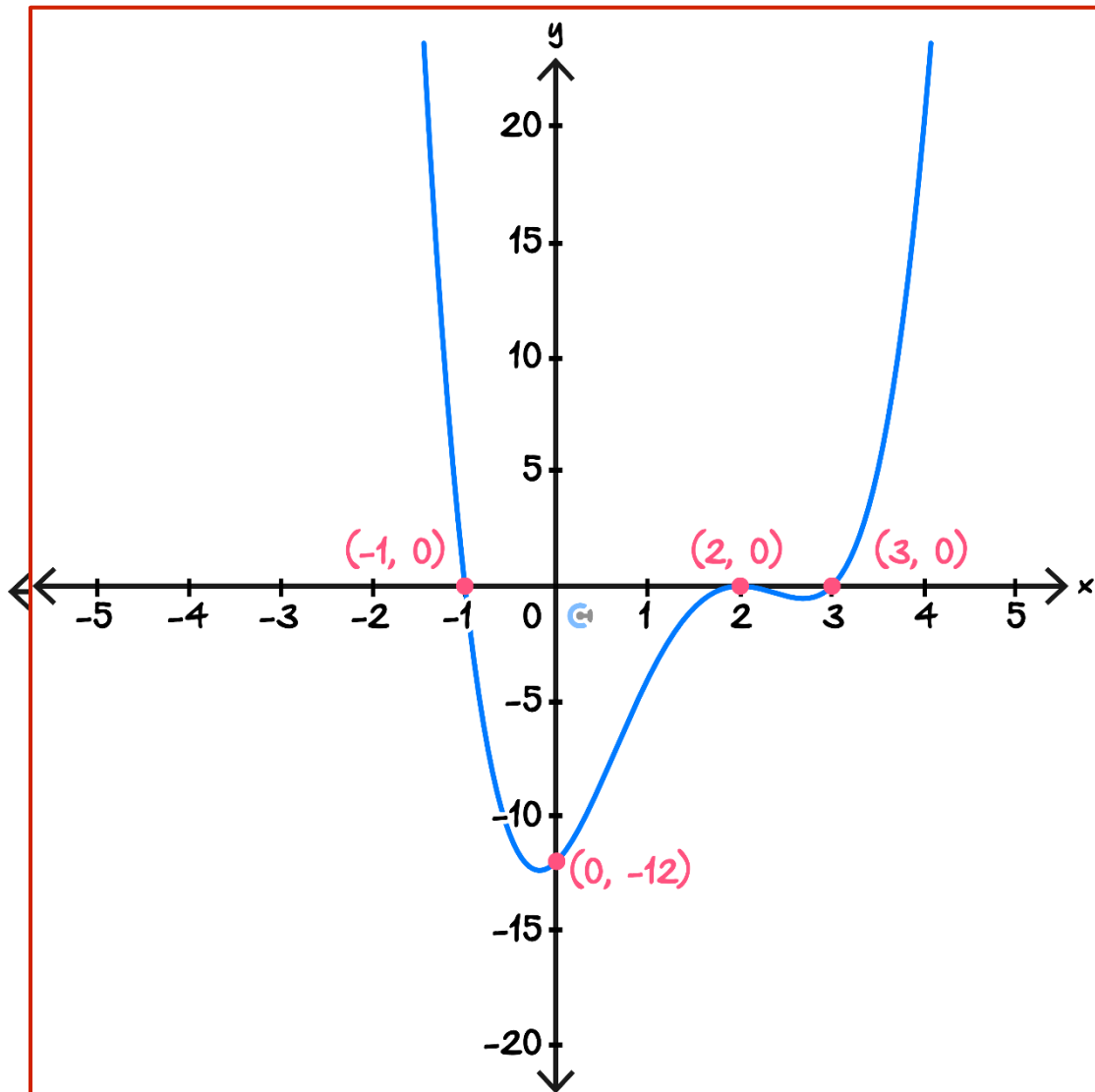
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Question 5 (6 marks)

Consider the function $f(x) = 2x^3 - 5x^2 - ax + 6$.

It is known that the remainder, when $f(x)$ is divided by $x - 3$, is 12.

a. Show that $a = 1$. (1 mark)

We have that $f(3) = 12$. Therefore,
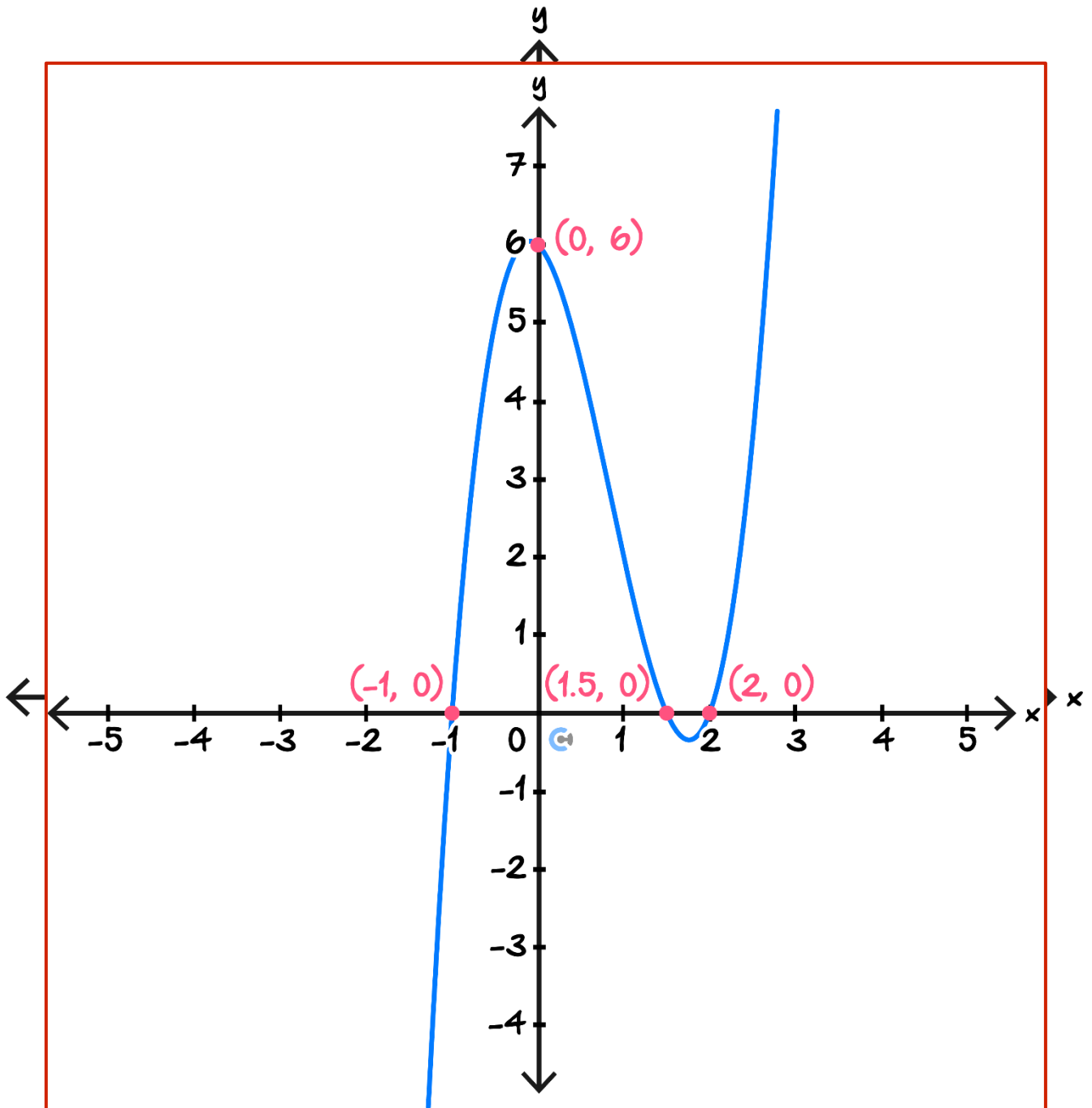$$f(3) = 54 - 45 - 3a + 6 = 12$$
$$15 - 3a = 12$$
$$a = 1$$

b. Hence, solve $f(x) = 0$. (3 marks)

We find that $f(-1) = 0$ and so $x + 1$ is a factor. We can then factorise $f(x)$ to be

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

And so $f(x) = 0$ has solutions $x = -1, \frac{3}{2}, 2$

c. Sketch the graph of $y = f(x)$ on the axes below. Label all axis intercepts with coordinates. (2 marks)

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