

**Polynomial Functions Test Review**

NAME: \_\_\_\_\_

**SECTION 1: Polynomial Functions in Standard and Factored Form**

1. Write the polynomial in standard form:  $f(x) = f(x) = -2x^4 - x^6 - 4 + 5x$

2. Find the degree, leading coefficient, and constant of each function:

	Function	Degree	Leading Coefficient	Constant
A	$f(x) = -2x^3 - x^2 + 5x - 1$			
B	$g(x) = 3(x + 2)(x - 4)$			None
C	$f(x) = -x^2 + 5x + 3$			
D	$f(x) = 3x^5 - x^{10}$			

3. Evaluate the polynomial function at  $x = -2$  using direct AND synthetic substitution .

$$f(x) = 3x^5 - x^3 + 6x^2 - x + 1$$

4. What does your answer to #3 mean? What would it mean if the answer to #3 was 0?

## SECTION 2: Polynomial Operations

Complete the polynomial operation.

6. $(3x^2 + x) + (2x + 5) + (6x - 1)$	7. $(2x^2 + 4x - 1) - (x^2 - 3x + 5)$
8. $(2x + 3)^2$	9. $(x - 4)^3$
10. $(x + 5i)(x - 5i)$	11. $(x + \sqrt{7})(x - \sqrt{7})$

Factor.

12. $x^3 + 64 =$	13. $x^2 + 64 =$
14. $x^3 - 64 =$	15. $x^2 - 64 =$
16. $125x^3 - 1$	17. $50x^2 - 8$
18. $x^2 + 3x - 10$	19. $6x^2 - 19x - 7$

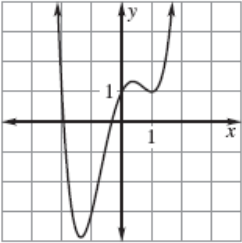
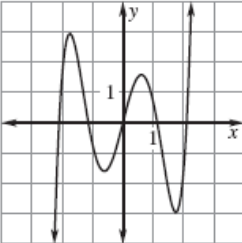
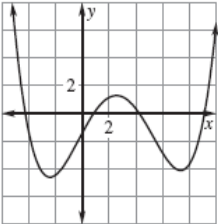
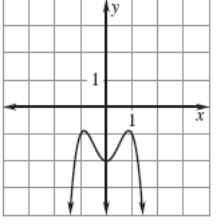
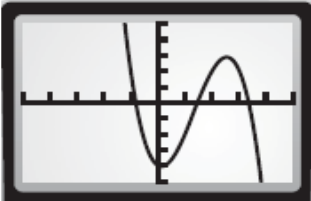
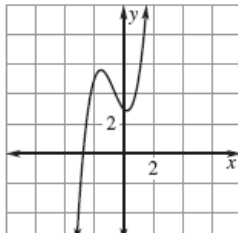
### SECTION 3: End Behavior

20. Draw a sketch of the end behavior of:  $h(x) = -2x^3 - 11x^3 + 9x^2 - 7x - 5$

21. Find the end behavior of:  $k(x) = 5x^4 - x^3 + 3x^2 - 2x - 5$

*As  $x \rightarrow +\infty$  then  $f(x) \rightarrow$  \_\_\_\_\_*

*As  $x \rightarrow -\infty$  then  $f(x) \rightarrow$  \_\_\_\_\_*

22.	Question	Answer A	Answer B
A	Describe the end behavior of the polynomial function whose graph is shown. 	As $x \rightarrow -\infty, f(x) \rightarrow -\infty$ As $x \rightarrow +\infty, f(x) \rightarrow -\infty$	As $x \rightarrow -\infty, f(x) \rightarrow +\infty$ As $x \rightarrow +\infty, f(x) \rightarrow +\infty$
B	Describe the end behavior of the polynomial function whose graph is shown. 	As $x \rightarrow -\infty, f(x) \rightarrow -\infty$ As $x \rightarrow +\infty, f(x) \rightarrow +\infty$	As $x \rightarrow -\infty, f(x) \rightarrow +\infty$ As $x \rightarrow +\infty, f(x) \rightarrow -\infty$
C	Which polynomial graph is being described? As $x \rightarrow -\infty, f(x) \rightarrow -\infty$ . As $x \rightarrow +\infty, f(x) \rightarrow -\infty$ .		
D	Which polynomial graph is being described? As $x \rightarrow -\infty, f(x) \rightarrow +\infty$ . As $x \rightarrow +\infty, f(x) \rightarrow -\infty$ .		
E	odd degree and positive leading coefficient	As $x \rightarrow +\infty, f(x) \rightarrow +\infty$	As $x \rightarrow +\infty, f(x) \rightarrow -\infty$
F	even degree and negative leading coefficient	As $x \rightarrow +\infty, f(x) \rightarrow +\infty$	As $x \rightarrow +\infty, f(x) \rightarrow -\infty$
G	$f(x) = -2x^5 + 3x^4 - 4x^3 + 5x^2 - 6x + 7$	As $x \rightarrow -\infty, f(x) \rightarrow -\infty$	As $x \rightarrow -\infty, f(x) \rightarrow +\infty$
H	$g(x) = 13x^4 - 11x^3 + 9x^2 - 7x - 5$	As $x \rightarrow -\infty, f(x) \rightarrow -\infty$	As $x \rightarrow -\infty, f(x) \rightarrow +\infty$

## SECTION 4: Zeros

23. Given the zero, find the factor.

5 \_\_\_\_\_

$-\frac{3}{4}$  \_\_\_\_\_

$2i$  \_\_\_\_\_

$\sqrt{5}$  \_\_\_\_\_

24. Given the factor, find the zero.

$x - 3$  \_\_\_\_\_

$2x + 1$  \_\_\_\_\_

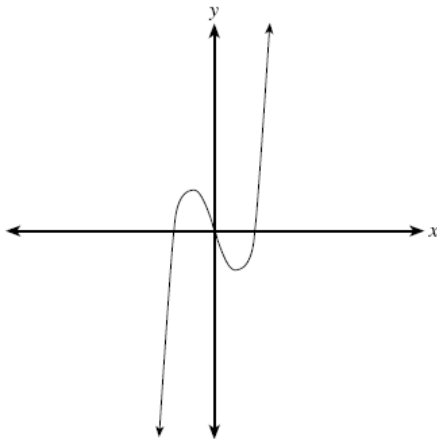
$5x - 10$  \_\_\_\_\_

$x - \sqrt{5}$  \_\_\_\_\_

25. Create a polynomial function **IN STANDARD FORM** with a leading coefficient of 2 and zeros at 0, 1, and 3.

A zero of  $f(x)$  is a number  $k$  such that  $f(k) = 0$ .

26.

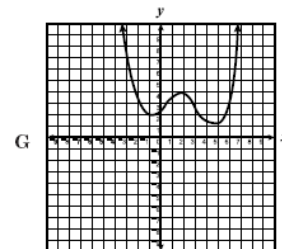
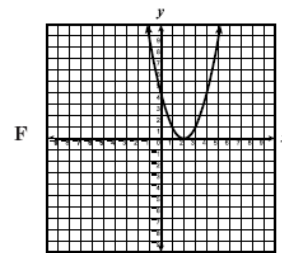


If  $a, b, c, d,$  and  $g$  are real numbers and  $a > 0$ , which equation could be represented by this curve?

- A  $y = ax + b$
- B  $y = ax^2 + bx + c$
- C  $y = ax^3 + bx^2 + cx + d$
- D  $y = ax^4 + bx^3 + cy^2 + dx + g$

27.

Which graph could represent a polynomial function with *no* real zeros?



28.

Which value is *not* a zero of  $P(x) = x^3 + 3x^2 - x - 3$ ?

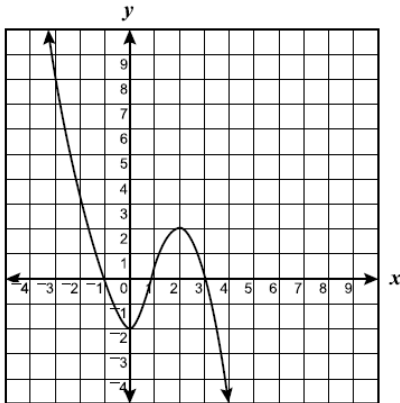
- A 1
- B -1
- C 3
- D -3

29.

Which quadratic equation has solutions  $x = \frac{1}{2}$  and  $x = \frac{2}{3}$ ?

- A  $6x^2 - 7x - 2 = 0$
- B  $6x^2 + 7x + 2 = 0$
- C  $6x^2 + 7x - 2 = 0$
- D  $6x^2 - 7x + 2 = 0$

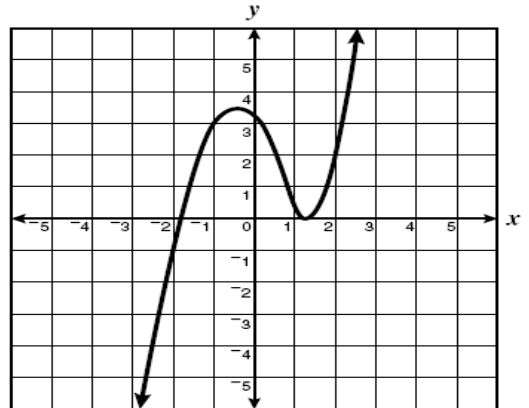
30.



The polynomial function shown apparently has zeros at —

- F -1 and 2
- G -1, 0.7, and 3
- H -2
- J 1, -0.7, and -3

31.

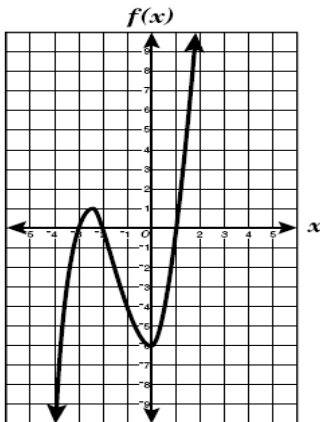


This is a portion of the graph of a polynomial function. Apparently the function has a double zero —

- F between -2 and -1
- G between -2 and 1
- H between 1 and 2
- J between 3 and 4

32.

$f(x) = x^3 + 4x^2 + x - 6$  is graphed below

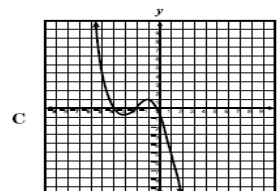
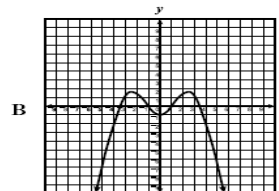
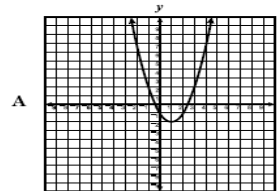


Which is the factored form of  $f(x)$ ?

- F  $f(x) = (x - 3)(x - 2)(x + 1)$
- G  $f(x) = x(2x + 5)(x - 1)$
- H  $f(x) = x(x + 3)(x + 2)$
- J  $f(x) = (x - 1)(x + 2)(x + 3)$

33.

Which graph could represent a third-degree polynomial function?



34. Which is a zero of the function  $f(x) = x^2 + 6x + 8$ ?

- F -8
- G -4
- H 2
- J 4

35. Which of the following functions has  $x$ -intercepts at -2 and 1?

- A  $y = x^2 - x - 2$
- B  $y = x^2 + x - 2$
- C  $y = x^2 - 2x + 1$
- D  $y = 2x - 1$

36. The polynomial function

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

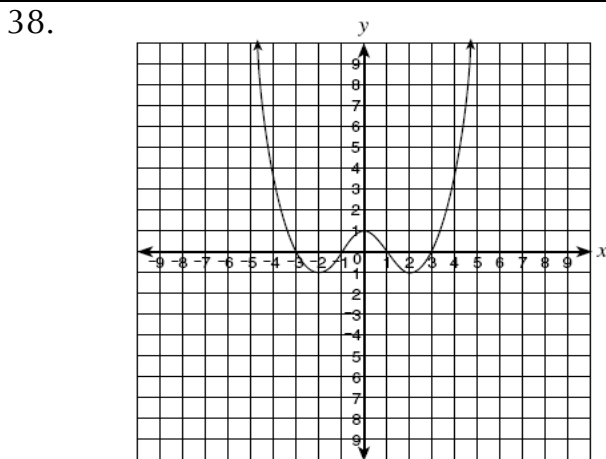
has a zero between —

- F -4 and -3
- G -2 and -1
- H -1 and 0
- J 3 and 4

37. What is the zero of the function

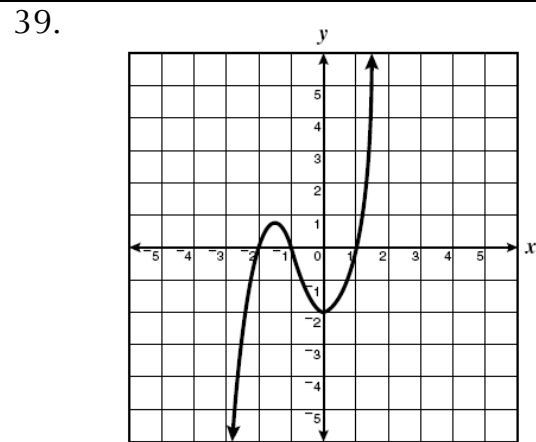
$$f(x) = 12x + 27?$$

- F 27
- G  $\frac{9}{4}$
- H 0
- J  $-\frac{9}{4}$



Which of the following sets contains all the apparent zeros for the function shown?

- F {1}
- G {-2, 0, 2}
- H {-2, 1, 2}
- J {-3, -1, 1, 3}



A section of the graph of a polynomial function with integral coefficients is shown. Which of the following sets most likely contains only elements that are factors of the polynomial?

- A  $\{(x - 2), (x - 1.5)\}$
- B  $\{(x - 2), (x - 1), (x + 1)\}$
- C  $\{(x + 2), (x + 1), (x - 1)\}$
- D  $\{x, (x - 2), (x - 1), (x + 1)\}$

40.

Which function of  $x$  would have  $x$ -intercepts  $-\frac{1}{2}$  and 3?

- F  $y = 2x^2 - 5x - 3$
- G  $y = x^2 - x - 6$
- H  $y = 2x^2 + 5x - 3$
- J  $y = 2x^2 + 7x + 3$

41.

Which is a zero of the function

$$f(x) = x^2 - 2x - 24?$$

- F -6
- G -3
- H 4
- J 6

42.

Which of the following is a zero of the function

$$f(x) = x^3 - x^2 - 14x + 24?$$

- F -4
- G -3
- H -2
- J 0

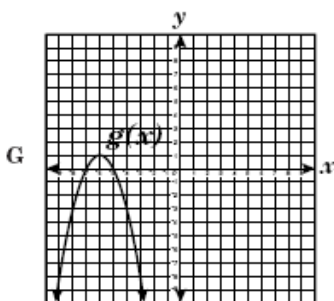
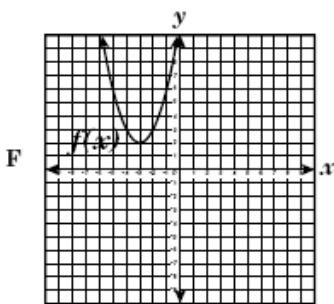
43.

A polynomial function has a zero at  $x = -4$ . Which expression *must* be a factor of the polynomial?

- F  $x - 4$
- G  $x - 2$
- H  $x + 2$
- J  $x + 4$

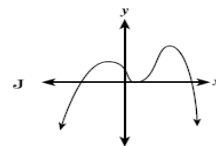
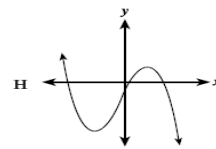
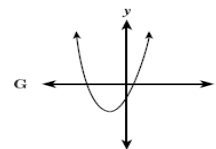
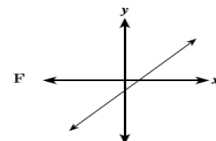
44.

Which apparently is a graph of a quadratic function that has no real zeros?



45.

Which could be a graph of  $y = ax^3 + bx^2 + cx + d$  if  $a, b, c,$  and  $d$  are real numbers and  $a < 0$ ?



Use SYNTHETIC DIVISION to DIVIDE the polynomials. Be sure to write your answer in the form of a polynomial and a remainder.

46. $(x^3 - 3x^2 + 8x - 5) \div (x - 1)$	47. $(x^4 - 7x^2 + 9x - 10) \div (x - 2)$
48. $(2x^4 - x^3 + 4) \div (x + 1)$	49. $(2x^4 - 11x^3 + 15x^2 + 6x - 18) \div (x - 3)$

Factor the following polynomials completely (given a factor).

50. $f(x) = x^3 - 3x^2 - 16x - 12;$ $(x - 6)$	51. $f(x) = x^3 - 12x^2 + 12x + 80;$ $(x - 10)$
52. $f(x) = x^3 - 18x^2 + 95x - 126;$ $(x - 9)$	53. $f(x) = x^3 - x^2 - 21x + 45;$ $(x + 5)$



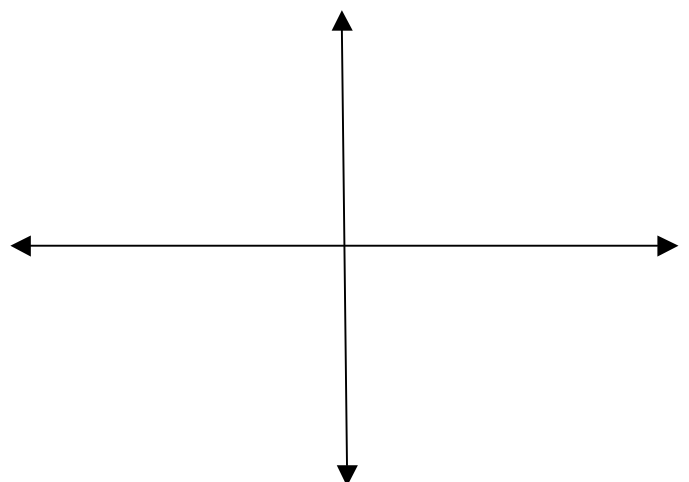
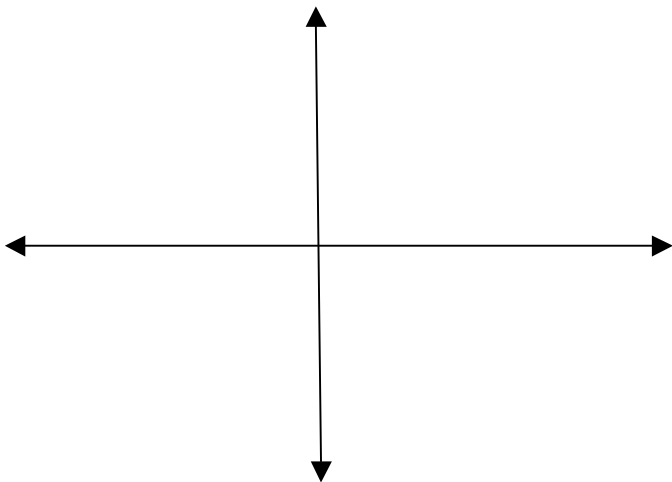
Factor the following polynomials completely (given a zero).

54.  $f(x) = x^3 + 2x^2 - 20x + 24$ ;  $-6$

55.  $f(x) = 15x^3 - 119x^2 - 10x + 16$ ;  $8$

56. Find all the zeros and sketch its graph.  
 $f(x) = 2x^3 + 3x^2 - 39x - 20$ ;  $4$  is a zero

57. Find all the zeros and sketch its graph.  
One zero of  $f(x) = x^4 + 3x^2 - 4$  is  $1$ .



58. List all the possible zeros of  $g(x) = x^3 - 2x^2 - 21x - 18$ . Then find all the zeros for the polynomial function. Show the synthetic division and other work for full credit.

Zeros: \_\_\_\_\_

59. List all the possible zeros of  $f(x) = x^3 + 2x^2 + 5x + 10$ . Then find all the zeros for the polynomial function. Show the synthetic division and other work for full credit.

Zeros: \_\_\_\_\_

60. List all the possible zeros of  $f(x) = 4x^3 - 12x^2 - x + 15$ . Then find all the zeros for the polynomial function. Show the synthetic division and other work for full credit.

Zeros: \_\_\_\_\_

## Sketch the polynomial functions

61.  $f(x) = x(x + 3)^2(x - 7)^4$

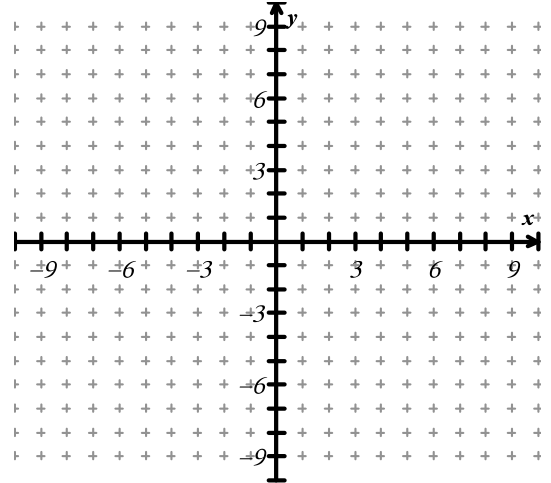
Degree: \_\_\_\_\_ Leading Coefficient: \_\_\_\_\_

Number of turning points: \_\_\_\_\_

End behavior:  $x \rightarrow \infty, f(x) \rightarrow$  \_\_\_\_\_  
 $x \rightarrow -\infty, f(x) \rightarrow$  \_\_\_\_\_

Zeros and multiplicity:

\_\_\_\_\_



62.  $f(x) = -4(x - 1)^2(x - 3)(x + 8)$

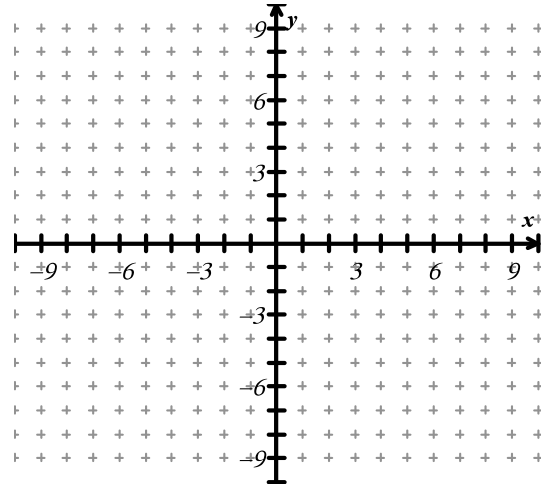
Degree: \_\_\_\_\_ Leading Coefficient: \_\_\_\_\_

Number of turning points: \_\_\_\_\_

End behavior:  $x \rightarrow \infty, f(x) \rightarrow$  \_\_\_\_\_  
 $x \rightarrow -\infty, f(x) \rightarrow$  \_\_\_\_\_

Zeros and multiplicity:

\_\_\_\_\_



63.

Domain: \_\_\_\_\_

Range: \_\_\_\_\_

Increasing: \_\_\_\_\_

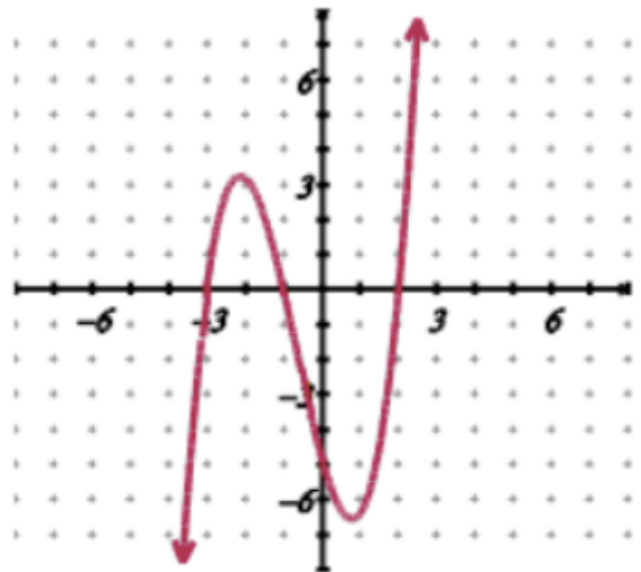
Decreasing: \_\_\_\_\_

Absolute Max: \_\_\_\_\_

Absolute Min: \_\_\_\_\_

Relative Max: \_\_\_\_\_

Relative Min: \_\_\_\_\_



## SECTION 5: FUNCTION OPERATIONS AND COMPOSITON

1.  $f(x) = 3x - 5$       $g(x) = 2x + 1$

a)  $f(x) + g(x)$

b)  $f(x) + g(x)$

c)  $f(x) g(x)$

$f(x) = 3x - 5$ $g(x) = 2x + 1$	5. $f(x) = 3x - 5$ $g(x) = 2x + 1$  Find $f \circ g$ .	6. $f(x) = x - 2$ $g(x) = x^2 + 3$  Find $g \circ f$ .
7. $f(x) = 5x - 6$ $g(x) = 3x$  Find $f(g(x))$ .	8. $f(x) = 2x^2 + 11$ $g(x) = 4x$  Find $g(f(x))$ .	9. $f(x) = x^2 - 9$ $g(x) = 3x^2$  Find $f \circ g(x)$ OR $f(g(x))$ .
10. $f(x) = 5x^2$ $g(x) = 6x - 2$  Find $f \circ f(x)$ . Also find $g \circ g(x)$ .	11. $f(x) = -4x + 6$ $g(x) = 5x - 1$  Find $f \circ g(2)$ OR $f(g(2))$ .	12. $f(x) = 2x^2$ $g(x) = x^2 + 7$  Find $f(g(-1))$ . Also find $g(f(-2))$ .