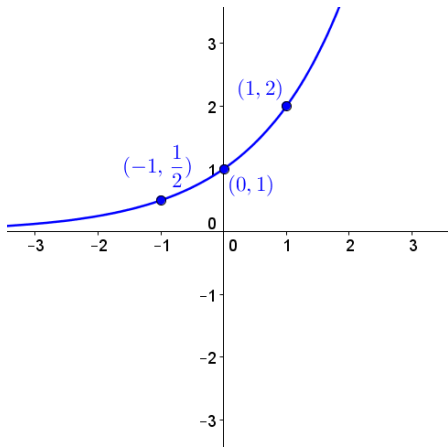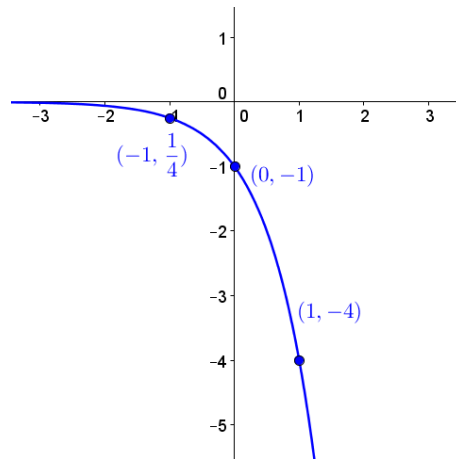# SM3 4.1 Exponential Graphs

Graph the following. Label the central point as well as two points on either side of it.
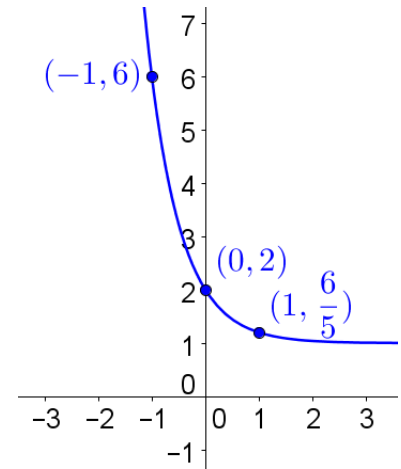
1. $y = 2^x$

$(1, 2)$
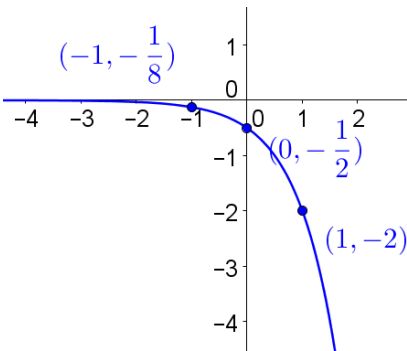$(-1, \frac{1}{2})$
$(0, 1)$

2. $y = -4^x$

$(-1, \frac{1}{4})$
$(0, -1)$
$(1, -4)$

3. $y = 5^{-x} + 1$

$(-1, 6)$
$(0, 2)$
$(1, \frac{6}{5})$

4. $y = -2(4)^{x-1}$

$(-1, -\frac{1}{8})$
$(0, -\frac{1}{2})$
$(1, -2)$

5. $y = -(2)^{x+2}$

$(-1, -2)$
$(0, -4)$
$(1, -8)$

6. $y = 2^x + 1$

$(-1, \frac{3}{2})$
$(0, 2)$
$(1, 3)$

7. $y = -\left(\frac{1}{4}\right)^x$

(1, $-\frac{1}{4}$)

(0, −1)

(−1, −4)

8. $y = 3\left(\frac{3}{2}\right)^x$

(1, $\frac{9}{2}$)

(0, 3)

(−1, 2)

9) $y = e^{-x}$

(−1, e)

(0, 1)

(1, $\frac{1}{e}$)

10. $y = -e^x$

(−1, $-\frac{1}{e}$)

(0, −1)

(1, $-e$)

11. $y = 3 + e^x$

(1, $e + 3$)

(0, 4)

(−1, $\frac{1}{e} + 3$)

12. $y = 4e^{x-1}$

(2, $4e$)

(1, 4)

(0, $\frac{4}{e}$)
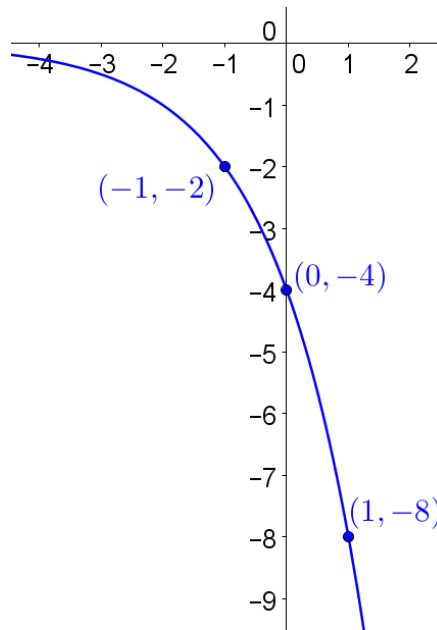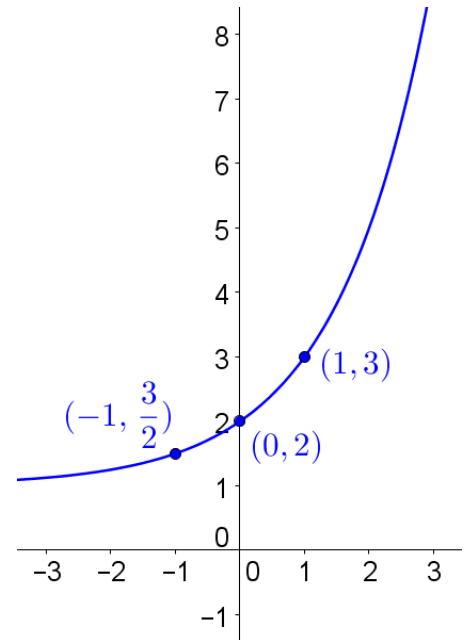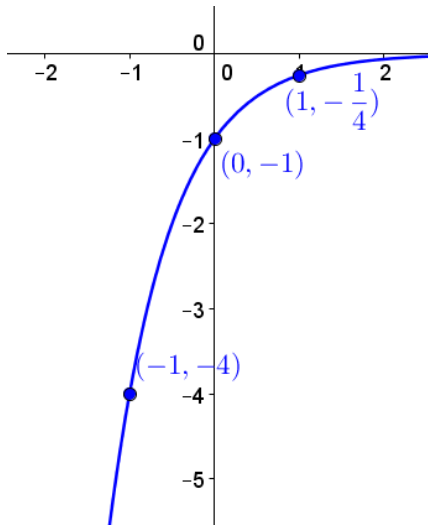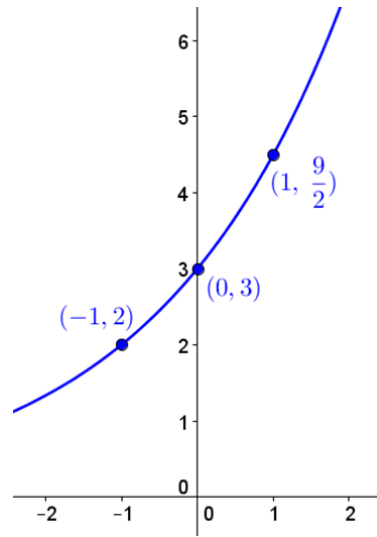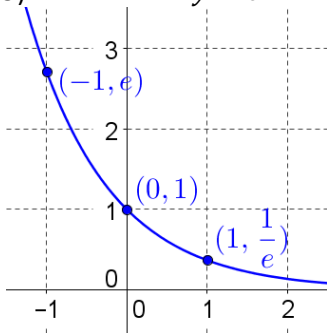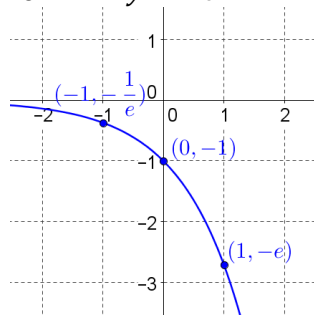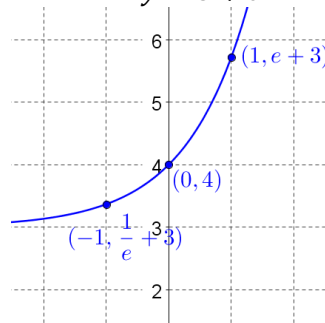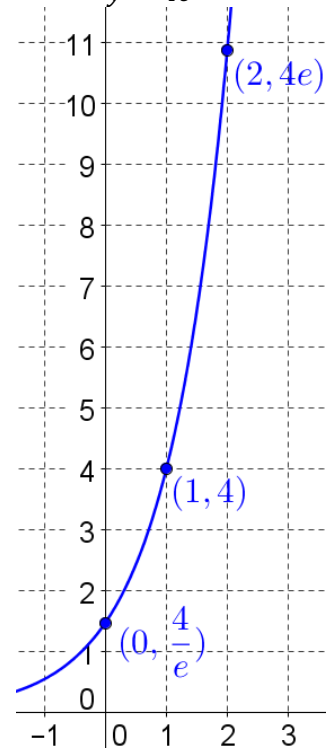
For problems 9-18 find the listed properties. You may graph the function if you find that it helps you to see the properties:

a. domain   b. range   c. intervals of increase and decrease
d. y-intercept   e. end behavior

13)

14)

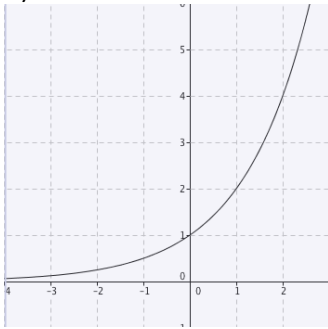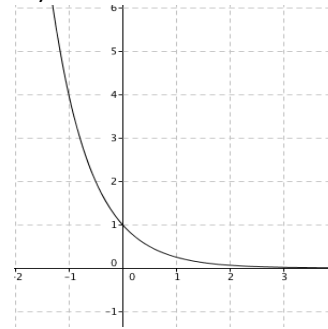$D = \mathbb{R}$
$R = (0, \infty)$
$\text{Inc} = \mathbb{R}, \text{Dec} = \emptyset$
y-int: $(0,1)$
$\lim\limits_{x \to -\infty} y = 0, \lim\limits_{x \to \infty} y = \infty$

$D = \mathbb{R}$
$R = (0, \infty)$
$\text{Inc} = \emptyset, \text{Dec} = \mathbb{R}$
y-int: $(0,1)$
$\lim\limits_{x \to -\infty} y = \infty, \lim\limits_{x \to \infty} y = 0$

15. $y = 3^x$

$D = \mathbb{R}$
$R = (0, \infty)$
$\text{Inc} = \mathbb{R}, \text{Dec} = \emptyset$
y-int: $(0,1)$
$\lim\limits_{x \to -\infty} y = 0, \lim\limits_{x \to \infty} y = \infty$

16. $y = 3^{-x}$

$D = \mathbb{R}$
$R = (0, \infty)$
$\text{Inc} = \emptyset, \text{Dec} = \mathbb{R}$
y-int: $(0,1)$
$\lim\limits_{x \to -\infty} y = \infty, \lim\limits_{x \to \infty} y = 0$

17. $y = -3^x$

$D = \mathbb{R}$
$R = (-\infty, 0)$
$\text{Inc} = \emptyset, \text{Dec} = \mathbb{R}$
y-int: $(0, -1)$
$\lim\limits_{x \to -\infty} y = 0, \lim\limits_{x \to \infty} y = -\infty$

18. $y = -3^{-x}$

$D = \mathbb{R}$
$R = (-\infty, 0)$
$\text{Inc} = \mathbb{R}, \text{Dec} = \emptyset$
y-int: $(0, -1)$
$\lim\limits_{x \to -\infty} y = -\infty, \lim\limits_{x \to \infty} y = 0$

19. $y = -2(3^x)$

$D = \mathbb{R}$
$R = (-\infty, 0)$
$\text{Inc} = \emptyset, \text{Dec} = \mathbb{R}$
y-int: $(0, -2)$
$\lim\limits_{x \to -\infty} y = 0, \lim\limits_{x \to \infty} y = -\infty$

20. $y = 2(3^x)$

$D = \mathbb{R}$
$R = (0, \infty)$
$\text{Inc} = \mathbb{R}, \text{Dec} = \emptyset$
y-int: $(0,2)$
$\lim\limits_{x \to -\infty} y = 0, \lim\limits_{x \to \infty} y = \infty$

21. $y = a(b^x)$, a and b are natural numbers greater than 1

$D = \mathbb{R}$
$R = (0, \infty)$
$\text{Inc} = \mathbb{R}, \text{Dec} = \emptyset$
y-int: $(0, a)$

$$\lim_{x\to-\infty} y = 0, \lim_{x\to\infty} y = \infty$$

22. $y = -a(b^x)$, a and b are natural numbers greater than 1

$D = \mathbb{R}$
$R = (-\infty, 0)$
$\text{Inc} = \emptyset, \text{Dec} = \mathbb{R}$
y-int: $(0, -a)$
$\lim_{x\to-\infty} y = 0, \lim_{x\to\infty} y = -\infty$

Find the average rate of change on the given interval.

23. $y = 5(2^x)$, $[3,5]$

24. $y = e^{(2x)}, (0,3)$

$f(3) = 40, f(5) = 160$	$(0,1), (3, e^6)$
$m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{(160) - (40)}{5 - 3} = \dfrac{120}{2}$	$m = \dfrac{y_2 - y_1}{x_2 - x_1}$
$m = 60$	$m = \dfrac{(e^6) - (1)}{(3) - (0)}$
	$m = \dfrac{e^6 - 1}{3}$