p.472–474
#1–14, 16, 18, 25, 27, 28, 31, 35, 37
(11.6)

$y = ab^x$

$y = kx^p$

1.) $p(x) = (5^x)^2$
$= 5^{2x}$
$= (5^2)^x$
$p(x) = 25^x$
$\boxed{\text{EXPONENTIAL}}$

2.) $g(x) = 5^{(x^2)}$
$\boxed{\text{NEITHER – VARIABLE IN EXPONENT IS SQUARED}}$

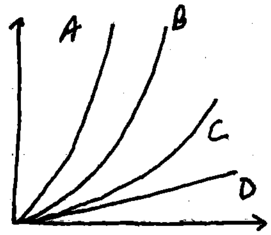
3.) $m(x) = 3(3x+1)^2$
$= 3(9x^2+6x+1)$
$= 27x^2+18x+3$
$\boxed{\text{NEITHER – NOT A POWER FUNCTION NOR EXPONENTIAL}}$

4.) $n(x) = 3 \cdot 2^{3x+1}$
$= 3 \cdot 2^{3x} \cdot 2^1$
$= 6 \cdot 2^{3x}$
$= 6 \cdot (2^3)^x$
$n(x) = 6 \cdot 8^x$
$\boxed{\text{EXPONENTIAL}}$

5.) $r(x) = 2 \cdot 3^{-2x}$
$= 2 \cdot (3^{-2})^x$
$= 2\left(\frac{1}{3^2}\right)^x$
$r(x) = 2\left(\frac{1}{9}\right)^x$
$\boxed{\text{EXPONENTIAL}}$

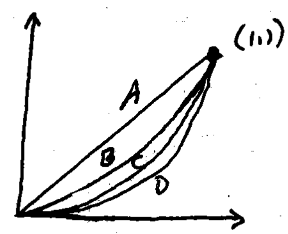
6.) $s(x) = \dfrac{4}{5x^{-3}}$
$= \dfrac{4x^3}{5}$
$s(x) = \frac{4}{5}x^3$
$\boxed{\text{POWER}}$

7.)



i) $y = x^5$ $\boxed{A}$
ii) $y = x^2$ $\boxed{C}$
iii) $y = x$ $\boxed{D}$
iv) $y = x^3$ $\boxed{B}$

8.)



i) $y = x^5$ $\boxed{D}$
ii) $y = x^2$ $\boxed{B}$
iii) $y = x$ $\boxed{A}$
iv) $y = x^3$ $\boxed{C}$

9.) $f(x) = 3^x$ $g(x) = x^3$

a.)

x	-3	-2	-1	0	1	2	3
$f(x)$	$\frac{1}{27}$	$\frac{1}{9}$	$\frac{1}{3}$	1	3	9	27
$g(x)$	-27	-8	-1	0	1	8	27

b.)
as $x \to \infty$ $f(x) \to \infty$ or $\lim_{x\to\infty} f(x) = \infty$
as $x \to -\infty$ $f(x) \to 0$ or $\lim_{x\to-\infty} f(x) = 0$
as $x \to \infty$ $g(x) \to \infty$ or $\lim_{x\to\infty} g(x) = \infty$
as $x \to -\infty$ $g(x) \to -\infty$ $\lim_{x\to-\infty} g(x) = -\infty$

WHICH FUNCTION DOMINATES?

10.) $y = ax^3$ $y = bx^2$ $a, b > 0$ $\boxed{y = ax^3}$

11.) $y = 7(.99)^x$ $y = 6x^{35}$ $\boxed{y = 6x^{35}}$
Decreasing

12.) $y = 4e^x$ $y = 2x^{50}$ $\boxed{y = 4e^x}$
Exponential Dominates

13.) $y = 50x^{1.1}$ $y = 1000x^{1.08}$ $\boxed{y = 50x^{1.1}}$
Higher power dominates

14.) $y = x^{-3}$ $y = 3^{-x}$

Which approach 0 faster?

$y = \frac{1}{x^3}$ $y = \frac{1}{3^x}$

$\frac{1}{2^3} = \frac{1}{8}$ $\frac{1}{3^2} = \frac{1}{9}$

$\frac{1}{10^3} = \frac{1}{1000}$ $\frac{1}{3^{10}} = \frac{1}{59{,}049}$

$\boxed{y = 3^{-x} \text{ approaches 0 faster}}$

16.) $y = x^x$

$\boxed{\text{NEITHER – CANNOT BE WRITTEN AS } y = ab^x \text{ OR } y = kx^p}$

18.) $f(1) = 16$ $f(2) = 128$

a.) LINEAR: $m = \frac{128-16}{2-1} = \frac{112}{1} = 112$

$y = mx + b$

$16 = 112(1) + b$

$16 = 112 + b$

$-96 = b$

$\boxed{y = 112x - 96}$

b.) EXPONENTIAL:

$\frac{y = ab^x}{y = ab^x} \Rightarrow \frac{128 = ab^2}{16 = ab^1} \Rightarrow$

$8 = b^1$

$y = ab^x$

$16 = a8^1$

$2 = a$

$\boxed{y = 2(8)^x}$

c.) POWER:

$\frac{y = kx^p}{y = kx^p} \Rightarrow \frac{128 = k(2)^p}{16 = k(1)^p}$

$8 = \left(\frac{2}{1}\right)^p \Rightarrow 8 = 2^p$ $p = 3$

$y = kx^p$

$16 = k(1)^3$

$16 = k$

$\boxed{y = 16x^3}$

LONG-RUN BEHAVIOR?

25.) $y = \frac{x^2+5}{x^8}$ $\boxed{\lim_{x\to\infty} y = 0 \quad \lim_{x\to-\infty} y = 0}$

27.) $y = \frac{2^t+7}{5^t+9}$ $\boxed{\lim_{t\to\infty} y = 0 \quad \lim_{t\to-\infty} y = \frac{7}{9}}$

WHEN $t = -2$: $\frac{2^{-2}+7}{5^{-2}+7} = \frac{\frac{1}{4}+7}{\frac{1}{5}+9}$

2^t and $5^t \to 0$ when $t \to -\infty$ so $y \to \frac{7}{9}$

28.) $y = \frac{3^{-t}}{4^t+7}$

$t \to \infty$ $3^{-t} = \frac{1}{3^t} \to 0$, $4^t \to \infty$ $\boxed{\lim_{t\to\infty} y = 0}$

$t \to -\infty$ $3^{-t} \to \infty$, $4^t \to 0$ $\to \frac{\infty}{0+7}$ $\boxed{\lim_{t\to-\infty} y = \infty}$

31.) $y = \frac{\ln x}{\sqrt{x}+5}$ $\boxed{\lim_{x\to\infty} \frac{\ln x}{\sqrt{x}} = 0}$

$\sqrt{x}$ dominates $\ln x$

Negative values not in domain of $\ln x$

35.) $y = \frac{e^x+5}{x^{100}+50}$ $\boxed{\lim_{x\to\infty} y = \infty}$

e^x dominates x^{100}

$x \to -\infty$ $\frac{\frac{1}{e^x}+5}{\infty+50} = \frac{5}{-\infty}$ $\boxed{\lim_{x\to-\infty} y = 0}$

37.)

x	-2	-1	0	1	2
$f(x)$	4	2	4	6	4
$g(x)$	20.0	2.5	0	-2.5	-20
$h(x)$	1.33	.67	.33	.17	.08

$f(x)$ is trig – Period = 4

$4 = \frac{2\pi}{B}$

$4B = 2\pi$

$B = \frac{\pi}{2}$

Amp $= \frac{6-2}{2} = 2$

Midline: $\frac{6+2}{2}$, $y = 4$

Sine

$\boxed{y = 2\sin\left(\frac{\pi}{2}x\right) + 4}$

$g(x)$ cannot be exponential because $(0,0)$ cannot be a point $y = ab^x$ since $a + b$ cannot equal zero. $\rightarrow$ $g(x)$ is a power function.

$\frac{y = kx^p}{y = kx^p} \Rightarrow \frac{-20 = k(2)^p}{-2.5 = k(1)^p}$

$8 = 2^p$

$y = kx^p$ $\Leftarrow 3 = p$

$-2.5 = k(1)^3$

$-2.5 = k$

$\boxed{y = -2.5x^3}$

$\frac{y = ab^x}{y = ab^x} \Rightarrow \frac{1.33 = ab^{-2}}{.67 = ab^{-1}}$

$2 = b^{-1}$

$2 = \frac{1}{b}$

$2b = 1$

$b = \frac{1}{2}$

$y = ab^x$

$.33 = a\left(\frac{1}{2}\right)^0$

$.33 = a$

$\boxed{y = \frac{1}{3}\left(\frac{1}{2}\right)^x}$