

حل مراجعة وفق كامل الهيكل الوزاري الجديد منهج ريفيل



تم تحميل هذا الملف من موقع المناهج الإماراتية

موقع المناهج ← المناهج الإماراتية ← الصف الحادي عشر المتقدم ← رياضيات ← الفصل الأول ← ملفات متنوعة ← الملف

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المزيد من مادة
رياضيات:

إعداد: طارق علي

التواصل الاجتماعي بحسب الصف الحادي عشر المتقدم



صفحة المناهج
الإماراتية على
فيسبوك

الرياضيات

اللغة الانجليزية

اللغة العربية

التربية الاسلامية

المواد على تلغرام

المزيد من الملفات بحسب الصف الحادي عشر المتقدم والمادة رياضيات في الفصل الأول

حل مراجعة وفق كامل الهيكل الوزاري الجديد منهج بريدج

1

حل كراسة تدريبية مراجعة وفق الهيكل الوزاري الجديد منهج بريدج

2

تجميع أسئلة وفق الهيكل الوزاري الجديد منهج بريدج

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كراسة تدريبية مراجعة وفق الهيكل الوزاري الجديد منهج بريدج

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الطارق

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فئة

منصة طارق أكاديمي للرياضيات

Tarek Academy

هيكل 11 متقدم ريفيل 2025



مرفع حادي عشر (متقدم ريفيل)

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أستاذ الرياضيات

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Q1-MCQ 5-1

Graph each function. Find the domain, range, y-intercept, asymptote, and end behavior.

1. $f(x) = 3^x$

a) Domain

- A) $(0, \infty)$
 B) $(-\infty, 0)$
~~C) $(-\infty, \infty)$~~
 D) $[1, \infty)$

c) y-intercept

- A) $(0, 0)$
 B) $(0, 3)$
 C) $(1, 0)$
~~D) $(0, 1)$~~

$$y = ab^{x-h} + k$$

Range
H.A

$$y = 3^0 = 1 \Rightarrow (0, 1)$$

b) Range

- ~~A) $(0, \infty)$~~
 B) $(-\infty, \infty)$
 C) $[0, \infty)$
 D) $(1, \infty)$

$$a + y > k \Rightarrow y > 0 \Rightarrow (0, \infty)$$

d) Asymptote

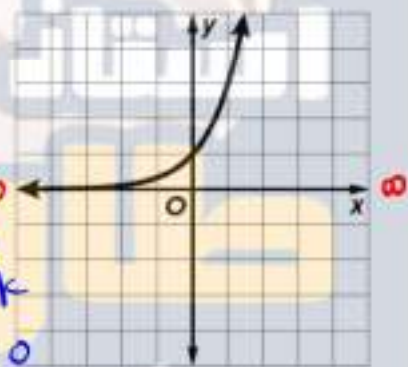
- A) $x = 0$
 B) $y = 1$
~~C) $y = 0$~~
 D) $x = 3$

$$H.A \quad y = k \quad y = 0$$

e) End Behavior as $x \rightarrow -\infty$ left

- A) $f(x) \rightarrow \infty$
 B) $f(x) \rightarrow 3$
~~C) $f(x) \rightarrow 0$~~
 D) $f(x) \rightarrow -\infty$

$$\text{left } -\infty \Rightarrow H.A \quad y = k \quad y = 0$$



في الرياضيات

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2. $f(x) = 5^x$

$$y = \overset{x}{5} + \overset{k}{0}$$

a) Domain

A) $(0, \infty)$

☒ B) $(-\infty, \infty)$

C) $(-\infty, 0)$

D) $[5, \infty)$

c) y-intercept

A) $(0, 5)$

B) $(0, 0)$

☒ C) $(0, 1)$

D) $(1, 0)$

$$y = \overset{0}{5}$$

$$y = 1$$

$$(0, 1)$$

b) Range

A) $(5, \infty)$

B) $(-\infty, \infty)$

☒ C) $(0, \infty)$

D) $[0, \infty)$

$$a +$$

$$y > k$$

$$y > 0$$

$$(0, \infty)$$

d) Asymptote

A) $x = 0$

B) $y = 5$

C) $x = 5$

☒ D) $y = 0$

$$H.A \rightarrow y = k$$

$$y = 0$$

e) End Behavior as $x \rightarrow \infty$

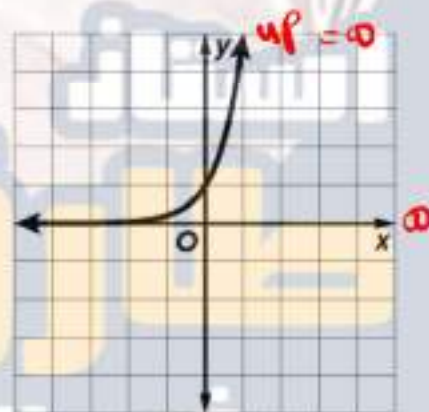
A) $f(x) \rightarrow 0$

B) $f(x) \rightarrow 1$

☒ C) $f(x) \rightarrow \infty$

D) $f(x) \rightarrow 5$

Right



$$H.A$$

$$y = k$$

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6. $f(x) = -2(4)^x + 0$

* $a (-)$ reflection
x-axis

a) Transformation from $y = 4^x$:

A) Vertical stretch by 2

☒ B) Vertical stretch by 2 and reflection over x-axis

C) Vertical stretch by 2 and shift down 2

D) Reflection over y-axis

* $a = 2 > 1$

stretch
vertically

b) Range:

A) $(0, \infty)$

☒ B) $(-\infty, 0)$

C) $(-\infty, \infty)$

D) $(-2, \infty)$

$a (-)$

$y < 0$

$y < 0$

$(-\infty, 0)$

d) As $x \rightarrow \infty$, $f(x) \rightarrow ?$

A) ∞

B) 0

C) -2

☒ D) $-\infty$

$a (-)$



c) y-intercept:

☒ A) $(0, -2)$

B) $(0, 2)$

C) $(0, -1)$

D) $(0, 0)$

$$y = -2(4)^x$$

$$y(0) = -2(4)^0 \Rightarrow (0, -2)$$

$$= -2$$

$a (-)$

$a +$



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$$9. f(x) = -0.4(3)^x + \frac{2}{h} + 4$$

* $a(-)$ reflection
x-axis

a) Transformation from $y = 3^x$:

* $a = 0.4 < 1$ Compressed
Vertically

A) Shift left 2, vertical compression by 0.4, reflection over x-axis, shift up 4

B) Shift right 2, vertical stretch by 0.4, reflection over y-axis, shift up 4

C) Shift left 2, vertical stretch by 0.4, shift up 4

D) Shift right 2, reflection over x-axis, shift up 4

* $h(\text{change}) = -2$
left

* $k = 4$ + up

b) Range:

$a(-)$

A) $(4, \infty)$

$y < k$

B) $(-\infty, 4)$

C) $(-\infty, \infty)$

$y < 4$

D) $(0, \infty)$

$(-\infty, 4)$

c) y-intercept:

$$y = -0.4(3)^{0+2} + 4$$

A) $(0, 4)$

$$y = 0.4$$

B) $(0, 0.4)$

$$\rightarrow (0, 0.4)$$

C) $(0, 2.4)$

D) $(0, 3.6)$

d) Asymptote:

$$H.A \rightarrow y = k$$

A) $y = 0$

B) $y = 4$

C) $y = -4$

D) $x = -2$

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10. $f(x) = 1.5(2)^x + 6$

* $a = 1.5 > 1$ stretch vertically

a) Transformation from $y = 2^x$:

A) Vertical stretch by 1.5 and shift right 6

* $k = 6$ up

☒ B) Vertical stretch by 1.5 and shift up 6

C) Vertical compression by 1.5 and shift up 6

D) Horizontal stretch by 1.5 and shift up 6

b) Domain:

A) $(6, \infty)$

B) $(-\infty, 6)$

☒ C) $(-\infty, \infty)$

D) $(0, \infty)$

c) Range:

A) $(0, \infty)$

☒ B) $(6, \infty)$

C) $(1.5, \infty)$

D) $(-\infty, \infty)$

$a > 1$
 $y > k$
 $y > 6$
 $(6, \infty)$

d) y-intercept:

A) $(0, 6)$

B) $(0, 1.5)$

☒ C) $(0, 7.5)$

D) $(0, 0)$

$y = 1.5(2^0) + 6$
 $y = 7.5$
 $(0, 7.5)$

e) Asymptote:

A) $y = 0$

☒ B) $y = 6$

C) $y = 1.5$

D) $x = 0$

$y = k$
 $y = 6$

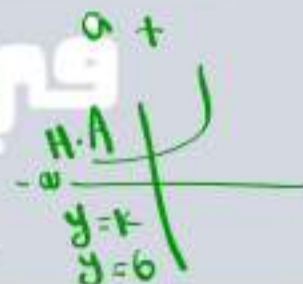
f) End Behavior as $x \rightarrow -\infty$:

A) $f(x) \rightarrow 0$

☒ B) $f(x) \rightarrow 6$

C) $f(x) \rightarrow \infty$

D) $f(x) \rightarrow -\infty$



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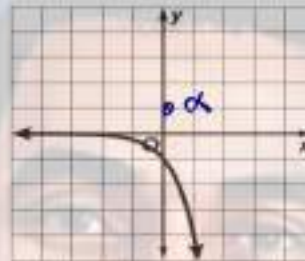


1. MULTIPLE CHOICE Select the graph of $f(x) = 4^x$. (Lesson 5-1)

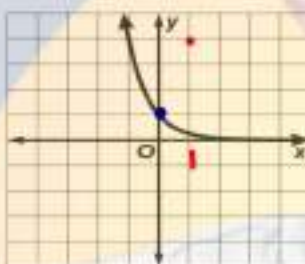
A.



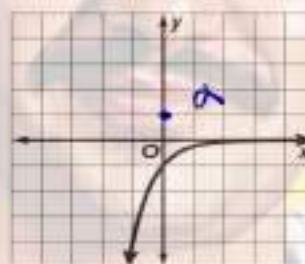
B.



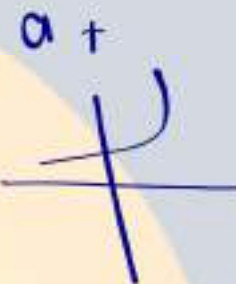
C.



D.



x	y
0	1
1	4
2	16



Q2-MCQ 5-3

Example 2 Graph Functions with Base e

Consider $g(x) = -2e^{x-3} + 2$.

* a (-) reflection x-axis

* a = 2 > 1 stretch vertically

a) Transformation from $y = e^x$:

A) Horizontal shift right 3, vertical stretch by 2, reflection over x-axis, vertical shift up 2

B) Horizontal shift left 3, vertical stretch by 2, reflection over y-axis, vertical shift up 2

C) Horizontal shift right 3, vertical stretch by 2, vertical shift up 2

D) Horizontal shift left 3, reflection over x-axis, vertical shift up 2

* h = +3 → right

* k = +2 → up

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b) Domain:

$$g(x) = -2e^{x-3} + 2.$$

A) $(0, \infty)$ B) $(-\infty, 2)$ ☒ C) $(-\infty, \infty)$ D) $(2, \infty)$

c) Range:

☒ A) $(-\infty, 2)$ B) $(-\infty, \infty)$ C) $(2, \infty)$ D) $(0, \infty)$

e) Asymptote:

A) $y = 0$ ☒ B) $y = 2$ C) $y = -2$ D) $x = 3$ f) End Behavior as $x \rightarrow \infty$:A) $g(x) \rightarrow 2$ B) $g(x) \rightarrow 0$ ☒ C) $g(x) \rightarrow -\infty$ D) $g(x) \rightarrow \infty$

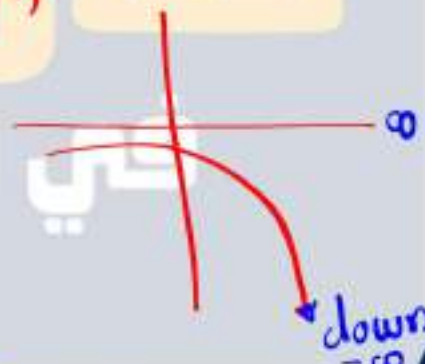
$$a \text{ (-)} \rightarrow y < 2$$

$$y < 2 \Rightarrow (-\infty, 2)$$

$$H.A \rightarrow y = 2$$

$$y = 2$$

$$a \text{ (-)}$$



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10. Consider the function $f(x) = 3e^{x-1} + 3$.

b. Determine domain and range.

a) Domain

A) $(3, \infty)$

☒ B) $(-\infty, \infty)$

C) $(0, \infty)$

D) $(-\infty, 3)$

b) Range

☒ A) $(3, \infty)$

B) $(-\infty, \infty)$

C) $(0, \infty)$

D) $(-\infty, 3)$

a +

$y > 3$

$y > 3$

$(3, \infty)$

c. Find the average rate of change over the interval $[-5, -2]$.

A) $\frac{3e^{-3} - 3e^{-6}}{3}$

B) $\frac{3e^{-2} - 3e^{-5}}{3}$

☒ C) $\frac{3e^{-3} + 3 - (3e^{-6} + 3)}{3}$

D) $\frac{3e^{-2} + 3 - (3e^{-5} + 3)}{-3}$

$$\text{avg} = \frac{f(b) - f(a)}{b - a}$$

$$= \frac{f(-2) - f(-5)}{-2 - -5}$$

$$f(x) = 3e^{x-1} + 3$$

$$\frac{(3e^{-2-1} + 3) - (3e^{-5-1} + 3)}{3}$$

$$\frac{(3e^{-3} + 3) - (3e^{-6} + 3)}{3}$$

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11. Consider the function $f(x) = 4e^{2x} - 1$.

b. Determine domain and range.

a) Domain

A) $(0, \infty)$

B) $(-\infty, -1)$

☒ C) $(-\infty, \infty)$

D) $(-1, \infty)$

b) Range

☒ A) $(-1, \infty)$

B) $(-\infty, -1)$

C) $(-\infty, \infty)$

D) $(0, \infty)$

$u(t)$

$y > k$

$y > -1$

$(-1, \infty)$

c. Find the average rate of change over the interval $[-3, -1]$.

A) $\frac{4e^{-2} - 4e^{-6}}{2}$

B) $\frac{4e^{-6} - 4e^{-2}}{2}$

☒ C) $\frac{4e^{-2} - 1 - (4e^{-6} - 1)}{2}$

D) $\frac{4e^{-2} - 4e^{-6}}{2}$

$\frac{f(-1) - f(-3)}{-1 - (-3)}$

$\frac{(4e^{2(-1)} - 1) - (4e^{2(-3)} - 1)}{2}$

$\frac{(4e^{-2} - 1) - (4e^{-6} - 1)}{2}$

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$$12. f(x) = -2e^{x+3} + 2$$

a) Domain

A) $(-\infty, 2)$

B) $(-\infty, \infty)$ *بأبته*

C) $(0, \infty)$

D) $(2, \infty)$

b) Range

A) $(-\infty, 2)$ *أ (-) y < 2*

B) $(2, \infty)$ *y < 2*

C) $(-\infty, \infty)$

D) $(0, \infty)$ *(-\infty, 2)*

c) Average rate of change on $[-7, -4]$

A) $\frac{-2e^{-4} + 2e^{-1}}{3}$

B) $\frac{-2e^{-1} + 2 + (-2e^{-4} + 2)}{3}$

C) $\frac{-2e^{-4} + 2 - (-2e^{-1} + 2)}{3}$

D) $\frac{-2e^{-1} + 2e^{-4}}{3}$

$$\frac{f(-4) - f(-7)}{-4 - -7}$$

$$\frac{(-2e^{-4+3} + 2) - (-2e^{-7+3} + 2)}{-4 - -7}$$

$$\frac{(-2e^{-1} + 2) - (-2e^{-4} + 2)}{-4 - -7}$$

$$\frac{-2e^{-1} + 2 + 2e^{-4} - 2}{-4 - -7} = \frac{-2e^{-1} + 2e^{-4}}{-4 - -7}$$

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Q3-MCQ 6-1

Write each equation in exponential form.

1. $\log_{15} 225 = 2$

a) $225 = 3^{-3}$

☒ b) $225 = 15^2$

c) $225 = 5^{-2}$

d) $225 = 3^5$

2. $\log_3 \frac{1}{27} = -3$

☒ a) $\frac{1}{27} = 3^{-3}$

b) $\frac{1}{27} = 15^2$

c) $\frac{1}{27} = 5^{-2}$

d) $\frac{1}{27} = 3^5$

3. $\log_5 \frac{1}{25} = 2$

a) $\frac{1}{25} = 3^{-3}$

☒ c) $\frac{1}{25} = 5^{-2}$

b) $\frac{1}{25} = 15^2$

d) $\frac{1}{25} = 3^5$

☒ 4. $\log_3 243 = 5$

5. $\log_4 64 = 3$

6. $\log_4 32 = \frac{5}{2}$

a) $243 = 3^{-3}$

$243 = 3^5$

b) $243 = 5^3$

c) $243 = 5^{-2}$

☒ d) $243 = 3^5$

☒ 5. $64 = 4^3$

$32 = 4^{\frac{5}{2}}$

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Write each equation in logarithmic form.

7. $2^7 = 128$
 down $\log_2 128 = 7$

8. $3^{-4} = \frac{1}{81}$

9. $7^{-2} = \frac{1}{49}$

$\log_7 \frac{1}{49} = -2$

a) $\log_7 128 = 2$

a) $\log_7 \frac{1}{49} = 2$

b) $\log_2 7 = 128$

~~b) $\log_7 \frac{1}{49} = -2$~~

c) $\log_2 128 = -7$

c) $\log_7 \frac{1}{2} = 49$

~~d) $\log_2 128 = 7$~~

d) $\log_2 49 = 7$

10. $\left(\frac{1}{7}\right)^3 = \frac{1}{343}$

11. $2^9 = 512$

12. $64^{\frac{2}{3}} = 16$

~~a) $\log_{\frac{1}{7}} \frac{1}{343} = 3$~~

a) $\log_{64} 16 = -\frac{2}{3}$

b) $\log_{\frac{1}{343}} \frac{1}{7} = 3$

b) $\log_{16} 64 = \frac{2}{3}$

c) $\log_3 \frac{1}{343} = 7$

c) $\log_{64} 16 = \frac{3}{2}$

d) $\log_{\frac{1}{3}} \frac{1}{343} = 7$

~~d) $\log_{64} 16 = \frac{2}{3}$~~

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Q4-MCQ 6-3

Example 5 Change of Base Formula

Evaluate $\log_2 11$ by writing it in terms of common logarithms. Round to the nearest ten-thousandth.

$$\log_2 11 =$$

$$= \frac{\log 11}{\log 2} = \frac{\ln 11}{\ln 2} = \frac{\log_4 11}{\log_4 2} = 3.4594$$

Change of Base Formula

Express each logarithm in terms of common logarithms. Then approximate its value to the nearest ten-thousandth.

21. $\log_4 22$

A) $\frac{\log 4}{\log 22}$

☒ B) $\frac{\log 22}{\log 4}$

C) $\frac{\ln 4}{\ln 22}$

D) $\log 88$

22. $\log_{12} 200$

A) $\frac{\log 12}{\log 200}$

☒ B) $\frac{\log 200}{\log 12}$

C) $\log 2400$

☒ D) $\frac{\ln 200}{\ln 12}$

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23. $\log_2 50$

☒ A) $\frac{\log 50}{\log 2}$

B) $\frac{\log 2}{\log 50}$

C) $\log 100$

☒ D) $\frac{\ln 50}{\ln 2}$

24. $\log_8 15$

A) $\frac{\log 8}{\log 15}$

☒ B) $\frac{\log 15}{\log 8} = \frac{\ln 15}{\ln 8} = \frac{\log_6 15}{\log_6 8}$

C) $\log 120$

☒ D) $\frac{\ln 15}{\ln 8}$

25. $\log_3 2$

☒ A) $\frac{\log 2}{\log 3}$

B) $\frac{\log 3}{\log 2}$

C) $\log 6$

☒ D) $\frac{\ln 2}{\ln 3}$

26. $\log_5 0.4$

☒ A) $\frac{\log 0.4}{\log 5}$

B) $\frac{\log 5}{\log 0.4}$

C) $\log 2$

☒ D) $\frac{\ln 0.4}{\ln 5}$

Q5-MCQ 6-4**Example 3** Simplify Logarithmic ExpressionsWrite $\frac{1}{3} \ln 8 - \ln 3 + \ln 9$ as a single logarithm.

$$\ln \sqrt[3]{8} - \ln 3 + \ln 9$$

$$\ln \frac{\sqrt[3]{8} \cdot 9}{3} = \ln 6$$

$+$ $\rightarrow \times$
 $-$ $\rightarrow \div$

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Write each expression as a single logarithm.

19. $3 \ln 3 - \ln 9 \rightarrow \div$

- A) $\ln 3$ $\ln 3^3 - \ln 9$
 B) $\ln 9$
 C) $\ln 18$ $\ln \frac{27}{9}$
 D) $\ln 27$ $\ln 3$

20. $4 \ln 16 - \ln 256$

- A) $\ln 4$ $\ln 16^4 - \ln 256$
 B) $\ln 16$
 C) $\ln 256$ $\rightarrow \div$
 D) $\ln 64$ $\ln \frac{16^4}{256} = \ln 256$

21. $2 \ln x + 2 \ln 4$

- A) $\ln(8x)$ $\ln x^2 + \ln 4^2$
 B) $\ln(16x^2)$ $+ \rightarrow \times$
 C) $\ln(4x^2)$ $\ln 16x^2$
 D) $\ln(8x^2)$

22. $3 \ln 4 + 3 \ln 3$

- A) $\ln 72$ $\ln 4^3 + \ln 3^3$
 B) $\ln 1728$ $+ \rightarrow \times$
 C) $\ln 144$ $\ln 64 \times 27$
 D) $\ln 432$

23. $\ln 125 - 2 \ln 5$

- A) $\ln 25$
 B) $\ln 5$
 C) $\ln 115$
 D) $\ln 1$
 $\ln 125 - \ln 5^2$
 $\ln \frac{125}{25} = \ln 5$

24. $3 \ln 10 + 2 \ln 100$

- A) $\ln 10^5$ $\ln 10^3 + \ln 100^2$
 B) $\ln 10^7$
 C) $\ln 10^6$ $\ln 10^3 \times 100^2$
 D) $\ln 10^8$ $\ln 10^3 \times (10^2)^2$
 $\ln 10^3 \times 10^4 = \ln 10^7$

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$$25. 4 \ln \frac{1}{3} - 6 \ln \frac{1}{9}$$

A) $\ln 9$

B) $\ln 3$

C) $\ln 27$

✓ D) $\ln 6561$

$$\ln \left(\frac{1}{3}\right)^4 - \ln \left(\frac{1}{9}\right)^6 \rightarrow \div$$

$$\ln \frac{\left(\frac{1}{3}\right)^4}{\left(\frac{1}{9}\right)^6} = \ln 6561$$

$$26. 7 \ln \frac{1}{2} + 5 \ln 2$$

A) $\ln 8$

B) $\ln 4$

✓ C) $\ln \frac{1}{4}$

D) $\ln 2$

$$\ln \left(\frac{1}{2}\right)^7 + \ln (2)^5$$

$$\ln \left(\frac{1}{2}\right)^7 \cdot (2)^5 = \ln \frac{1}{4}$$

$$27. 8 \ln x - 4 \ln 5$$

✓ A) $\ln \left(\frac{x^8}{5^4}\right)$

B) $\ln \left(\frac{x^8}{62}\right)$

C) $\ln \left(\frac{x^8}{20}\right)$

D) $\ln \left(\frac{8x}{625}\right)$

$$\ln x^8 - \ln 5^4 \rightarrow \div$$

$$\ln \frac{x^8}{5^4}$$

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Q6-MCQ 6-5

Example 1 Continuous Exponential Growth

POPULATION In 2016, the population of Florida was 20.61 million people. In 2000, it was 15.98 million.

Part A Write an exponential growth equation.

A) $P(t) = 15.98e^{0.0159t}$

B) $P(t) = 20.61e^{0.0159t}$

C) $P(t) = 15.98(1.016)^t$

D) $P(t) = 20.61(1.016)^t$

$$t = 2016 - 2000 = 16$$

$$20.61 = 15.98 e^{16k}$$

Shift $\rightarrow$ solve

$$k = 0.0159$$

$$y = 15.98 e^{0.0159t}$$

Part B Predict when the population will reach 25 million people.

A) 2025

B) 2028

C) 2030

D) 2035

$$t = ?$$

$$25 = 15.98 e^{0.0159t}$$

Shift $\rightarrow$ solve $t \approx 28$

$$t = 28 + 2000$$

$$t = 2028$$

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Check

SCIENCE An experiment starts with 20 bacteria A cells. After 45 minutes, there are 710 bacteria A cells.

Part A

Write the equation that models the number of bacteria A cells y after t minutes. Round the value of k to the nearest thousandth.

☒ A) $y(t) = 20e^{0.079t}$

B) $y(t) = 710e^{0.079t}$

C) $y(t) = 20e^{0.088t}$

D) $y(t) = 710e^{0.088t}$

$$710 = 20 e^{45k}$$

$$k = 0.079$$

$$y = 20 e^{0.079t}$$

Part B

After how many minutes will there be 1000 bacteria A cells? Round to the nearest tenth if necessary.

_____ minutes

A) 48.2 minutes

☒ B) 49.5 minutes

C) 50.7 minutes

D) 52.1 minutes

$$1000 = 20 e^{0.079t}$$

Shift $\rightarrow$ solve.

$$t = 49.5$$

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1. **POPULATION** In 2000, the world population was estimated to be 6.124 billion people. In 2005, it was 6.515 billion.

- a. Write an exponential growth equation to represent the population y in billions t years after 2000.

A) $y = 6.124(1.012)^t$

B) $y = 6.515(1.04)^t$

C) $y = 6.124e^{0.012t}$

D) $y = 6.515e^{0.04t}$

$$t = 2005 - 2000 = 5$$

$$6.515 = 6.124 e^{5k}$$

Shift $\rightarrow$ solve

$\rightarrow =$

$$k = 0.01238$$

- b. Use the equation to predict the year in which the world population reached 7.5 billion people.

$$y = 7.5$$

$$y = 6.124 e^{0.012t}$$

A) 2015

B) 2016

C) 2020

D) 2023

$$7.5 = 6.124 e^{0.012t}$$

$$t \approx 16$$

$$\Rightarrow \text{year} = 2000 + 16 = 2016$$

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2. **CONSUMER AWARENESS** Jason wants to buy a new HD television but he thinks that if he waits, the quality of HD televisions will improve. The television he wants to buy costs \$2500 now, and based on pricing trends, Jason thinks that the price will increase by 4% each year.

$$r = \frac{4}{100} = 0.04$$

- a. Write an exponential growth equation to represent the price y of a new HD television t years from now.

A) $y = 2500(0.96)^t$

B) $y = 2500(1.04)^t$

C) $y = 2500e^{0.04t}$

D) $y = 2600(1.04)^t$

$$a = 2500$$

$$y = a e^{rt}$$

$$y = 2500 e^{0.04t}$$

- b. Use the equation to predict when a new HD television will cost \$3000.

$$y = 2500 e^{0.04t}$$

A) 3 years

B) 4.6 years

C) 5 years

D) 6 years

$$3000 = 2500 e^{0.04t}$$

Alpha
e

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Q7-MCQ 7-1

Simplify each expression, and state when the original expression is undefined.

$$1. \frac{x(x-3)(x+6)}{x^2+x-12} = \frac{2(2-3)(2+6)}{2^2+2-12} = \frac{-16}{-6} = \boxed{\frac{8}{3}} \quad x=2$$

$$A) \frac{x(x+6)}{x+4}, x \neq -4, 3 = \frac{2(2+6)}{2+4} = \boxed{\frac{8}{3}}$$

$$B) \frac{x+6}{x+4}, x \neq -4$$

$$C) \frac{x}{x+4}, x \neq -4, 3$$

$$D) \frac{x-3}{x+4}, x \neq -4, 3$$

* undefined: $\boxed{\text{deno} = 0}$

$$x^2+x-12=0$$

Mode $\rightarrow 5 \rightarrow 3$, Mode $\rightarrow$ equation $\rightarrow 2 \rightarrow 2$
 $x = 3$, $x = -4$

$$2. \frac{y^2(y^2+3y+2)}{2y(y-4)(y+2)} = \frac{2^2(2^2+3(2)+2)}{2(2)(2-4)(2+2)} = \boxed{-\frac{3}{2}}$$

$$A) \frac{y+1}{2(y-4)}, y \neq 0, 4, -2$$

$$B) \frac{y(y+1)}{2(y-4)}, y \neq 0, 4, -2 = \frac{2(2+1)}{2(2-4)} = \boxed{-\frac{3}{2}}$$

$$C) \frac{y+1}{y-4}, y \neq 4, -2 \quad * \text{undefined: } \text{deno} = 0$$

$$D) \frac{y^2+1}{2(y-4)}, y \neq 0, 4, -2$$

$$2y=0 \rightarrow y=0$$

$$y-4=0 \rightarrow y=4$$

$$y+2=0 \rightarrow y=-2$$

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$$3. \frac{(x^2-9)(x^2-z^2)}{4(x+z)(x-3)} = \frac{(2^2-9)(2^2-3^2)}{4(2+3)(2-3)} = -\frac{5}{4} \quad x=2, z=3$$

$$A) \frac{(x+3)(x-z)}{4}, x \neq -z, 3 = \frac{(2+3)(2-3)}{4} = -\frac{5}{4}$$

$$B) \frac{x+3}{4}, x \neq -z, 3$$

* undefined deno = 0

$$C) \frac{x-z}{4}, x \neq -z, 3$$

$$x+z=0 \rightarrow x=-z$$

$$D) \frac{x^2-9}{4}, x \neq -z, 3$$

$$x-3=0 \rightarrow x=3$$

$$5. \frac{x^2(x+2)(x-4)}{6x(x^2+x-20)} = \frac{2^2(2+2)(2-4)}{6(2)(2^2+2-20)} = \frac{-32}{-168} = \frac{4}{21}$$

$$A) \frac{x(x+2)}{6(x+5)}, x \neq 0, 4, -5 = \frac{2(2+2)}{6(2+5)} = \frac{8}{42} = \frac{4}{21}$$

$$B) \frac{x+2}{6(x+5)}, x \neq 0, 4, -5$$

* undefined: deno = 0

$$C) \frac{x}{6(x+5)}, x \neq 0, 4, -5$$

$$6x=0 \rightarrow x=0$$

$$D) \frac{x+2}{x+5}, x \neq 0, 4, -5$$

$$x^2+x-20=0$$

$$\begin{array}{l} x=4 \\ x=-5 \end{array}$$

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$$8. \frac{9x^2 - x^3}{x^2 - 3x - 54} = \frac{9(2)^2 - 2^3}{2^2 - 3(2) - 54} = \frac{28}{-56} = -\frac{1}{2}$$

$$A) \frac{x^2}{x+6}, x \neq 9, -6$$

$$B) \frac{x^2}{x+6}, x \neq 9, -6$$

$$C) -\frac{x^2}{x+6}, x \neq 9, -6$$

$$D) \frac{9-x}{x+6}, x \neq 9, -6$$

$$-\frac{2^2}{2+6} = -\frac{1}{2} \checkmark$$

* undefined: deno = 0

$$x^2 - 3x - 54 = 0 \text{ دالة}$$

$$x = -6$$

$$x = 9$$

$$10. \frac{16 - c^2}{c^2 + c - 20} = \frac{16 - 2^2}{2^2 + 2 - 20} = -\frac{6}{7}$$

$$A) -\frac{c+4}{c+5}, c \neq 4, -5 = -\frac{2+4}{2+5} = -\frac{6}{7}$$

$$B) \frac{c+4}{c+5}, c \neq 4, -5$$

$$C) -\frac{c-4}{c+5}, c \neq 4, -5$$

$$D) \frac{c-4}{c+5}, c \neq 4, -5$$

* undefined: deno = 0

$$c^2 + c - 20 = 0 \text{ دالة}$$

$$c = 4$$

$$c = -5$$

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Q8-MCQ 7-2

Simplify each expression.

$$x = 2$$

$$y = 3$$

$$1. \frac{3}{x} + \frac{5}{y} = \frac{3}{2} + \frac{5}{3} = \frac{19}{6}$$

$$\text{A) } \frac{3y+5x}{xy} = \frac{3(3)+5(2)}{(2)(3)} = \frac{19}{6}$$

$$\text{B) } \frac{8}{x+y}$$

$$\text{C) } \frac{3y-5x}{xy}$$

$$\text{D) } \frac{15}{xy}$$

$$2. \frac{3}{8p^2r} + \frac{5}{4p^2r} = \frac{3}{8(2)^2(3)} + \frac{5}{4(2)^2(3)} = \frac{13}{96}$$

$$p = 2$$

$$r = 3$$

$$\text{A) } \frac{13}{4p^2r}$$

$$\text{B) } \frac{2}{p^2r}$$

$$\text{C) } \frac{13}{8p^2r} = \frac{13}{8(2)^2(3)} = \frac{13}{96}$$

$$\text{D) } \frac{8}{8p^2r}$$

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$$3. \frac{2c-7}{3} + 4 = \frac{2(2)-7}{3} + 4 = \boxed{3} \quad c=2$$

A) $\frac{2c-19}{3}$

B) $\frac{2c+5}{3} = \frac{2(2)+5}{3} = \boxed{3}$

C) $\frac{2c-3}{3}$

D) $\frac{2c+19}{3}$

$$6. \frac{7}{4gh} + \frac{3}{4h^2} = \frac{7}{4(2)(3)} + \frac{3}{4(3)^2} \quad \begin{matrix} g=2 \\ h=3 \end{matrix}$$

$$= \frac{7}{24} + \frac{3}{36} = \frac{3}{8}$$

A) $\frac{7+3g}{4gh}$

B) $\frac{7g+3h}{4gh^2}$

C) $\frac{7h+3g}{4gh^2} = \frac{7(3)+3(2)}{4(2)(3)^2} = \frac{3}{8}$

D) $\frac{10}{4gh^2}$

$$9. \frac{k}{k-n} - \frac{k}{n-k} = \frac{2}{2-3} - \frac{2}{3-2} \quad \text{A) } 0$$

$k=2$
 $n=3$

$= -4$

B) $\frac{k}{k-n}$

C) $\frac{2k}{n-k}$

D) $\frac{2k}{k-n}$

$$-4 = \frac{2(2)}{2-3} =$$

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$$10. \frac{4z}{z-4} + \frac{z+4}{z+1} = \frac{4(2)}{2-4} + \frac{2+4}{2+1} \quad z=2$$

$$= \boxed{-2}$$

A) $\frac{5z^2+z+16}{(z-4)(z+1)}$

B) $\frac{5z^2+z-16}{(z-4)(z+1)}$

☒ C) $\frac{5z^2+4z-16}{(z-4)(z+1)}$

D) $\frac{5z^2+4z+16}{(z-4)(z+1)}$

$$\frac{5(2)^2 + 4(2) - 16}{(2-4)(2+1)} = -2$$

$$\frac{5(2)^2 + 4(2) + 16}{(2-4)(2+1)} \neq -2$$

$$12. \frac{3}{y^2+y-12} - \frac{2}{y^2+6y+8} = \frac{3}{2^2+2-12} - \frac{2}{2^2+6(2)+8}$$

$$= -\frac{7}{12}$$

A) $\frac{y-6}{(y+4)(y-3)(y+2)}$

☒ B) $\frac{y+12}{(y+4)(y-3)(y+2)} = \frac{2+12}{(2+4)(2-3)(2+2)} = -\frac{7}{12}$

C) $\frac{y-18}{(y+4)(y-3)(y+2)}$

D) $\frac{y+6}{(y+4)(y-3)(y+2)}$

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Q9-MCQ 7-4

Find the zeros and asymptotes of each function. Then graph each function.

$$11. f(x) = \frac{(x-4)^2}{x+2} = \frac{x^2 - 8x + 16}{x+2}$$

A. Zero: $x=4$; VA: $x=-2$; HA: None; SA: $y=x-6$

B. Zero: $x=4$; VA: $x=-2$; HA: $y=1$; SA: None

C. Zero: $x=-4$; VA: $x=2$; HA: $y=0$; SA: None

☒ D. Zero: $x=4$ (multiplicity 2); VA: $x=-2$; HA: None; SA: $y=x-10$

* Zero num = 0 $x-4=0 \rightarrow x=4$

* V.A deno = 0 $x+2=0 \rightarrow x=-2$

* H.A $\rightarrow$ Power up more No H.A

* S.A (long division) = $\frac{x^2 - 8x + 16}{x+2}$
or Synthetic

-2	1	-8	16
	$\downarrow$	-2	20
	1	-10	$36 \Rightarrow R$

قسط

$y = x - 10$ Slant
Asymptotes

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$$13. f(x) = \frac{6x^2 + 4x + 2}{x + 2}$$

A. Zeros: $x=1$, $x=1/3$; VA: $x=-2$; HA: $y=6$ ✓ B. No real zeros; VA: $x=-2$; HA: None; SA: $y=6x-8$ C. Zero: $x=-1$; VA: $x=2$; HA: $y=6$; SA: NoneD. No real zeros; VA: $x=2$; HA: $y=0$; SA: None

* Zeros num = 0 $6x^2 + 4x + 2 = 0$ بسط

No real zeros Complex

* V.A $\rightarrow$ deno = 0 $x + 2 = 0$ $x = -2$

* H.A power up more No H.A

* S.A $\frac{6x^2 + 4x + 2}{x + 2}$

-2	6	4	2
	$\downarrow$	-12	16
	6	-8	18

Slant Asymptote $y = 6x - 8$

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$$14. f(x) = \frac{2x^2 + 7x}{x-2}$$

A. Zeros: $x=0$, $x=-7/2$; VA: $x=2$; HA: $y=2$; SA: None✓ B. Zeros: $x=0$, $x=-7/2$; VA: $x=2$; HA: None; SA: $y=2x+11$ C. Zeros: $x=0$, $x=7/2$; VA: $x=-2$; HA: $y=2$; SA: NoneD. Zeros: $x=0$, $x=7$; VA: $x=2$; HA: None; SA: $y=2x+3$

* Zeros $2x^2 + 7x = 0$ $x = 0$
 $x = -\frac{7}{2}$

* V.A deno = 0 $x - 2 = 0$ $x = 2$

* H.A (None)

* S.A $\frac{2x^2 + 7x}{x-2}$

$$\begin{array}{r|rrrr} 2 & 2 & 7 & 0 & \\ & \downarrow & 4 & 22 & \\ \hline & 2 & 11 & 22 & \end{array}$$

slant Asymptote $y = 2x + 11$

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Graph each function. Find the point discontinuity.

$$17. f(x) = \frac{x^2 - 2x - 8}{x - 4}$$

- ✓ A. Point discontinuity at $x=4$; Simplified: $f(x)=x+2$
 B. Point discontinuity at $x=-2$; Simplified: $f(x)=x-4$
 C. Point discontinuity at $x=8$; Simplified: $f(x)=x-2$
 D. No point discontinuity; VA at $x=4$

$$f(x) = \frac{(x-4)(x+2)}{(x-4)} = \boxed{x+2}$$

discon at $x-4=0 \rightarrow \boxed{x=4}$
 انكسار

$$= \frac{(x+6)(x-2)}{(x-2)} = x+6$$

✓
 discon $\rightarrow x-2=0$

$$\boxed{x=2}$$

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$$19. f(x) = \frac{x^2 - 25}{x + 5} = \frac{(x-5)(x+5)}{(x+5)} = x-5$$

A. Point discontinuity at $x=5$; Simplified: $f(x)=x+5$ B. No point discontinuity; VA at $x=-5$ ✓ C. Point discontinuity at $x=-5$; Simplified: $f(x)=x-5$ D. Point discontinuity at $x=25$; Simplified: $f(x)=x-25$

* discon $x+5=0 \rightarrow \boxed{x=-5}$

$$21. f(x) = \frac{(x-4)(x^2-4)}{x^2-6x+8} = \frac{(x-4)(x-2)(x+2)}{(x-4)(x-2)} = x+2$$

A. Point discontinuity at $x=2$; Simplified: $f(x)=x+2$ ✓ B. Point discontinuity at $x=2$ and $x=4$; $f(x)=x+2$ C. Point discontinuity at $x=2$; Simplified: $f(x)=(x^2-4)/(x-2)$ D. No point discontinuity; VAs at $x=2$ and $x=4$

discon

$$x-4=0$$

$$\boxed{x=4}$$

$$x-2=0$$

$$\boxed{x=2}$$

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$$22. f(x) = \frac{(x+5)(x^2+2x-3)}{x^2+8x+15}$$

A. Point discontinuity at $x=-5$; Simplified: $f(x)=x-1$

B. Point discontinuity at $x=-5$ and $x=-3$: $f(x)=x-1$

C. Point discontinuity at $x=-5$; Simplified: $f(x)=x+1$

D. No point discontinuity; VAs at $x=-5$ and $x=-3$

$$F(x) = \frac{\cancel{(x+5)}(\cancel{x+3})(x-1)}{(\cancel{x+3})(\cancel{x+5})}$$

$$F(x) = x - 1$$

* disCon

$$x + 5 = 0$$

$$x = -5$$

$$x + 3 = 0$$

$$x = -3$$

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Q10-MCQ 7-5

If a varies jointly as b and c , find a when $b = 4$ and $c = -3$.

7. $a_2 = -96$ when $b = 3$ and $c = -8$

$$\frac{a_1}{b_1 c_1} = \frac{a_2}{b_2 c_2}$$

$$\frac{a_1}{4 \times -3} = \frac{-96}{3 \times -8}$$

Shift
Solve
↓
=

- ☒ A) -48
B) -36
C) 48
D) 36

8. $a = -60$ when $b = -5$ and $c = 4$
find a when $b = 4$ and $c = -3$.

$$\frac{a_1}{b_1 c_1} = \frac{a_2}{b_2 c_2}$$

$$\frac{a_1}{4 \times -3} = \frac{-60}{-5 \times 4}$$

- A) -48
☒ B) -36
C) 48
D) 36

find a when $b = 4$ and $c = -3$.

9. $a = -108$ when $b = 2$ and $c = 9$

$$\frac{a_1}{b_1 c_1} = \frac{a_2}{b_2 c_2}$$

$$\frac{a_1}{4 \times -3} = \frac{-108}{2 \times 9}$$

- A) 90
B) 14
☒ C) 72
D) -3



find a when $b = 4$ and $c = -3$.

A) 90

10. $a = 24$ when $b = 8$ and $c = 12$

shift
solve

B) 14

C) 72

✓ D) -3

$$\frac{a_1}{11 \times -3} = \frac{24}{8 \times 12}$$

11. If y varies jointly as x and z , and $y = 18$ when $x = 2$ and $z = 3$, find y when x is 5 and z is 6.

✓ A) 90

B) 14

C) 72

D) -3

$$\frac{y_1}{x_1 \cdot z_1} = \frac{y_2}{x_2 \cdot z_2}$$

$$\frac{18}{2(3)} = \frac{y_2}{5(6)}$$

12. If y varies jointly as x and z , and $y = -16$ when $x = 4$ and $z = 2$, find y when x is -1 and z is 7.

A) 90

B) 14

C) 72

D) -3

$$\frac{y_1}{x_1 \cdot z_1} = \frac{y_2}{x_2 \cdot z_2}$$

$$\frac{-16}{4(2)} = \frac{y_2}{(-1)(7)}$$



Q11-MCQ 7-6

Solve each equation. Check your solutions.

1. $\frac{2x+3}{x+1} = \frac{3}{2}$

- ☒ A) -3
☐ B) 3
☐ C) 0
☐ D) 2
- Shift Solve =*

2. $\frac{-12}{y} = y - 7$

- ☐ A) -3
☒ B) 3, 4
☐ C) 0
☐ D) 2
- * Shift → Solve*
 $x = 4$
 (3) *نحوه*
 $\frac{-12}{3} = 3 - 7$
 $-4 = -4$ ✓

3. $\frac{9}{x-7} - \frac{7}{x-6} = \frac{13}{x^2 - 13x + 42}$

- ☐ A) -3
☒ B) 9
☐ C) 0
☐ D) 2
- $\frac{9}{a-7} - \frac{7}{a-6} = \frac{13}{6}$
 $\frac{13}{a^2 - 13(a) + 42} = \frac{13}{6}$

4. $\frac{13}{y+3} - \frac{12}{y+4} = \frac{18}{y^2 + 7y + 12}$

- ☐ A) -3
☐ B) 9
☐ C) 0
☒ D) 2

Shift Solve =

5. $\frac{14}{x-2} - \frac{18}{x+1} = \frac{22}{x^2 - x - 2}$

- ☒ A) 7
☐ B) 9
☐ C) 0.5
☐ D) 2
- Shift Solve =*

6. $\frac{2}{a+2} + \frac{10}{a+5} = \frac{36}{a^2 + 7a + 10}$

- ☐ A) 7
☐ B) 9
☒ C) 0.5
☐ D) 2

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$$7. \frac{x}{2x-1} + \frac{3}{x+4} = \frac{21}{2x^2+7x-4}$$

A) 7

B) 9

C) No real solution

D) 2, -12

shift
solve
 $x = -12$
 $x = 2$

$$8. \frac{2}{y-5} + \frac{y-1}{2y+1} = \frac{2}{2y^2-9y-5}$$

A) 7

B) 9

C) No real solution

D) 2, -12

$$9. \frac{x-8}{2x+2} + \frac{x}{2x+2} = \frac{2x-3}{x+1}$$

A) 7

B) 9

C) No real solution

D) 2

left $\neq$ Right

$$10. \frac{12p+19}{p^2+7p+12} - \frac{3}{p+3} = \frac{5}{p+4}$$

A) 7

B) 9

C) No real solution

D) 2

$$11. \frac{2f}{f^2-4} + \frac{1}{f-2} = \frac{2}{f+2}$$

$$\frac{2(-6)}{(-6)^2-4} + \frac{1}{-6-2} = -\frac{1}{2}$$

A) -6

B) 9

C) No real solution

D) 5, -1

$$\frac{2}{-6+2} = -\frac{1}{2}$$

$$12. \frac{8}{t^2-9} + \frac{4}{t+3} = 1$$

shift
solve

A) -6

B) 9

C) No real solution

D) 5, -1

 $x = -1$
 $x = 5$

$$\frac{8}{25-9} + \frac{4}{5+3} = 1$$

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Q12-MCQ 8-1

Identify each sample or question as *biased* or *unbiased*. Explain your reasoning.

4. A random sample of eight people is asked to select their favorite food for a survey about Americans' food preferences.

☒ A) Biased

☐ B) Unbiased

5. Every tenth student at band camp is asked to name his or her favorite band for a survey about the campers.

☐ A) Biased

☒ B) Unbiased

6. Every fifth person entering a museum is asked to name his or her favorite type of book to read for a survey about reading interests of people in the city.

☒ A) Biased

☐ B) Unbiased

7. Do you think that the workout facility needs a new treadmill and racquetball court?

☒ A) Biased

☐ B) Unbiased

8. Which is your favorite type of music, pop, or country?

☒ A) Biased

☐ B) Unbiased

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9. Are you a member of any after-school clubs?

شكوك
في

A) Biased

B) Unbiased

10. Don't you agree that employees should pack their lunch?

الأنفاق

A) Biased

B) Unbiased

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Q13-MCQ 8-2

1. A student spun a spinner with 4 equal sections 100 times and recorded the results.

Spinner Section	Frequency
Red	35
Blue	38
Green	13
Yellow	14

- a. Find the theoretical probability of spinning blue.
Write your answer as a percentage rounded to the nearest tenth, if necessary.

☒ a) 25% ☐ b) 38% ☐ c) 50% ☐ d) 58.4%

$$P = \frac{\text{Part}}{\text{Total}} = \frac{1}{4} \quad \text{or} \quad \frac{1}{4} \times 100\% = 25\%$$

- b. Find the experimental probability of spinning blue.
Write your answer as a percentage rounded to the nearest tenth, if necessary.

Spinner Section	Frequency
Red	35
Blue	38
Green	13
Yellow	14

a) 25% ☒ b) 38% ☐ c) 50% ☐ d) 58.4%

$$P = \frac{\text{blue}}{\text{Total}} = \frac{38}{100} = 0.38$$

Total = 100

$$\text{or} \quad 0.38 \times 100\% = 38\%$$

2. A student flipped a coin 125 times and recorded the results.

Coin Result	Frequency
Heads	73
Tails	52

- a. Find the theoretical probability of the coin landing on heads. Write your answer as a percentage rounded to the nearest tenth, if necessary.

☐ a) 25% ☐ b) 38% ☒ c) 50% ☐ d) 58.4%

$$P = \frac{1}{2} \times 100\% = 50\%$$

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- b. Find the experimental probability of the coin landing on heads. Write your answer as a percentage rounded to the nearest tenth, if necessary.

a) 25% b) 38% c) 50% ☒ d) 58.4%

$$\text{Head} = 73, \quad \text{Total} = 73 + 52 = 125$$

$$P = \frac{73}{125} \times 100\% \approx 58.4\%$$

3. A fair 6-sided die is rolled 150 times.

- a. Find the theoretical probability of rolling a 3. Write your answer as a percentage rounded to the nearest tenth, if necessary.

a) 18/50 b) 27/150 c) 4/30 ☒ d) 1/6

Number on Die	Frequency
1	32
2	18
3	27
4	16
5	33
6	24

$$P = \frac{1}{6}$$

- b. Find the experimental probability of rolling a 3. Write your answer as a percentage rounded to the nearest tenth, if necessary.

a) 18/50 ☒ b) 27/150 c) 4/30 d) 1/6

Number on Die	Frequency
1	32
2	18
☒ 3	☒ 27
4	16
5	33
6	24

$$P = \frac{27}{150}$$

$$\text{Total} = 150$$

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4. MULTIPLE CHOICE Leonard randomly selected a card from a standard deck of playing cards, recorded the suit, and returned the card. He followed this set of steps 120 times. The results are shown.

Suit	Frequency
Heart 1	28
Diamond 2	37
Spade 3	34
Club 4	21

Which statement about the results is true?

- A. The theoretical probability of selecting a heart is less than the experimental probability of selecting a heart.
- ☒ B. The theoretical probability of selecting a diamond is less than the experimental probability of selecting a diamond.
- C. The experimental probability of selecting a club is greater than the theoretical probability of selecting a club.
- D. The experimental probability of selecting a heart is equal to the experimental probability of selecting a diamond.

$$* P(\text{Theoretical}) = \frac{1}{4} = 0.25$$

$$* P(\text{Experimental}) = \frac{37}{120} \approx 0.31$$

$$0.25 < 0.31$$

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Q14-MCQ 8-3

Example 1 Find a Standard Deviation

TRACK A coach recorded the times of each track member for a 400-meter race. Find and interpret the standard deviation of the data.

400m Race Times (seconds)	
57.1	55.9
59.3	54.9
54.6	50.3
55.2	53.5

a. 2.5

b. 2.35

c. 2.45

d. 4.5

* Mode $\rightarrow$ Stat (6) $\rightarrow$ 1 $\rightarrow$ AC

* option $\rightarrow$ 2

Standard deviation = 2.45

$$\begin{aligned} \sum x &= 55.1 \\ \sum x^2 &= 440.8 \\ \sigma^2 x &= 24336.26 \\ \sigma x &= 6.0225 \\ s^2 x &= 2.454078238 \\ s x &= 6.882857143 \end{aligned}$$

1. **BARBER** A barber wants to purchase new professional shears from a Web site. The prices of all of the shears are shown in the table. Use the standard deviation formula to find and interpret the standard deviation of the data. Round your answers to the nearest cent.

Cost of Shears (\$)			
50	165	55	79
84	68	38	42

a) 22.38 b) 38.22 c) 5.2 d) 2.5

* Mode $\rightarrow$ 6 $\rightarrow$ 1 $\rightarrow$ AC

* option $\rightarrow$ 2

$\sigma x = 38.2162$

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2. **READING** Ms. Sanchez keeps track of the total number of books each student in the book club reads during the school year. Use the standard deviation formula to find and interpret the standard deviation of the data. Round your answers to the nearest tenth.

Books Read		
9	6	12
8	9	14
10	13	8

a) 22.38 b) 38.22 c) 5.2 ☒ d) 2.5

* Mode $\rightarrow 6 \rightarrow 1 \rightarrow \dots \rightarrow AC$

* Option $\rightarrow 2$ $\sigma_x = 2.46 \approx 2.5$

7. **MULTI-SELECT** Zain is analyzing two sets of data. (Lesson 8-3)

Set A				
35	28	35	33	32
32	31	30	36	49
36	33	29	34	37

Set B				
22	26	26	24	27
38	35	31	22	30
24	33	30	25	38

$$* \text{avg} = \frac{\text{Sum}}{n}$$

$$\frac{510}{15} = 34$$

$$* \sigma_x = 11.76$$

$$\text{avg} = \frac{431}{15} = 28.7$$

$$\sigma_x = 5.195 \approx 5.20$$

- * Select all the true statements about each data set.

- ☒ A. Data set A has a higher average value.
☐ B. Data set B has a higher average value.
☐ C. Data set A is more varied.

- ☒ D. Data set B is more varied. $\text{as } \sigma \text{ more of B}$



Q15-MCQ 9-1

REGULARITY Rewrite each degree measure in radians and each radian measure in degrees.

$$54. 18^\circ \times \frac{\pi}{180}$$

- ~~a) $\pi/30$~~ $\frac{1}{10} \times \pi$
~~b) $-41\pi/9$~~
~~c) $\pi/10$~~ $\frac{\pi}{10}$
~~d) $-2\pi/5$~~

$$55. 6^\circ \times \frac{\pi}{180}$$

- ~~a) $\pi/30$~~
~~b) $-41\pi/9$~~
~~c) $\pi/10$~~
~~d) $-2\pi/5$~~

$$56. -72^\circ \times \frac{\pi}{180}$$

- ~~a) $\pi/30$~~ $-\frac{2}{5} \times \pi$
~~b) $-41\pi/9$~~
~~c) $\pi/10$~~ $-\frac{2\pi}{5}$
~~d) $-2\pi/5$~~

$$57. -820^\circ \times \frac{\pi}{180}$$

- ~~a) $\pi/30$~~
~~b) $-41\pi/9$~~
~~c) $\pi/10$~~
~~d) $-2\pi/5$~~

$$58. 4\pi \times \frac{180}{\pi}$$

- ~~a) 450~~ 4×180
~~b) -105~~ $= 720$
~~c) -810~~
~~d) 720~~

$$59. \frac{5\pi}{2} \times \frac{180}{\pi}$$

- ~~a) 450~~ $\frac{5 \times 180}{2}$
~~b) -105~~
~~c) -810~~
~~d) 720~~

$$60. -\frac{9\pi}{2} \times \frac{180}{\pi}$$

- ~~a) 450~~ $-\frac{9 \times 180}{2}$
~~b) -105~~
~~c) -810~~
~~d) 720~~

$$61. -\frac{7\pi}{12} \times \frac{180}{\pi}$$

- ~~a) 450~~ $-\frac{7 \times 180}{12}$
~~b) -105~~
~~c) -810~~
~~d) 720~~

$$62. -270^\circ$$

- ~~a) $\pi/30$~~
~~b) $-41\pi/9$~~
~~c) $\pi/10$~~
~~d) $-3\pi/2$~~

$$-270 \times \frac{\pi}{180}$$

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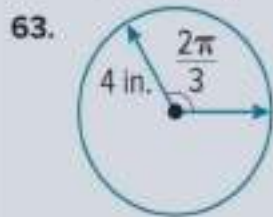
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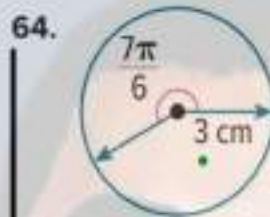
Find the length of each arc. Round to the nearest tenth. * $S = r\theta \rightarrow$ Radian π 8.



$$S = r\theta$$

$$= 4 \times \frac{2\pi}{3}$$

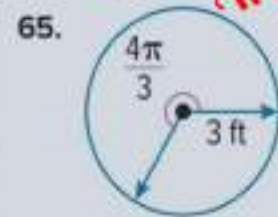
- a) 11.0
b) 41.3
c) 8.4
d) 12.6



$$S = r\theta$$

$$= 3 \times \frac{7\pi}{6}$$

- a) 11.0
b) 41.3
c) 8.4
d) 12.6
- shift $\times 10^x$
10.9
 ≈ 11



$$S = r\theta$$

$$= 3 \times \frac{4\pi}{3}$$

- a) 11.0
b) 41.3
c) 8.4
d) 12.6

Q16-MCQ 9-2

Find the exact value of each trigonometric function.

40. $\tan 330^\circ$

- A) $-\frac{\sqrt{3}}{3}$
B) $-\sqrt{3}$
C) $\frac{\sqrt{3}}{3}$
D) $\sqrt{3}$

41. $\cos\left(-\frac{11\pi}{4}\right)$ Radian

- A) $-\frac{\sqrt{2}}{2}$
B) $\frac{\sqrt{2}}{2}$
C) $-\frac{1}{2}$
D) $\frac{1}{2}$
- * Shift $\rightarrow$ Mode $\rightarrow$ Rad
قبة

* Shift $\rightarrow$ Mode
دقيقة. 2 $\rightarrow$ 2

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42. $\cot 30^\circ =$

$$\frac{1}{\tan(30)}$$

A) $\frac{\sqrt{3}}{3}$

B) $\sqrt{3}$

C) $\frac{1}{2}$

D) 1

43. $\csc \frac{\pi}{4} =$

$$\frac{1}{\sin(\frac{\pi}{4})}$$

A) $\sqrt{2}$

B) $\frac{\sqrt{2}}{2}$

C) 2

D) $\frac{1}{2}$

44. $\sin(-150^\circ)$

A) $-\frac{1}{2}$

B) $\frac{1}{2}$

C) $-\frac{\sqrt{3}}{2}$

D) $\frac{\sqrt{3}}{2}$

* degree *

Shift →
mode → 2
→ 1

45. $\tan(-\frac{\pi}{4})$

A) -1

B) 1

C) 0

D) $-\sqrt{3}$

* Radian *

Shift → mode
2 → 2**Q17-MCQ 9-3**

The terminal side of angle θ in standard position intersects the unit circle at each point P.
Find $\cos \theta$ and $\sin \theta$.

1. P $(-\frac{\sqrt{3}}{2}, \frac{1}{2})$

* $\cos \theta = x = -\frac{\sqrt{3}}{2}$

A) $\cos \theta = -\frac{\sqrt{3}}{2}, \sin \theta = \frac{1}{2}$

B) $\cos \theta = \frac{1}{2}, \sin \theta = -\frac{\sqrt{3}}{2}$

C) $\cos \theta = \frac{\sqrt{3}}{2}, \sin \theta = \frac{1}{2}$

D) $\cos \theta = -\frac{1}{2}, \sin \theta = \frac{\sqrt{3}}{2}$

* $\sin \theta = y = \frac{1}{2}$

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2. $P(0, -1)$

A) $\cos \theta = -1, \sin \theta = 0$

✓ B) $\cos \theta = 0, \sin \theta = -1$

C) $\cos \theta = 1, \sin \theta = 0$

D) $\cos \theta = 0, \sin \theta = 1$

$$(\cos \theta, \sin \theta)$$



0



-1

3. $P\left(-\frac{2}{3}, \frac{\sqrt{5}}{3}\right)$

A) $\cos \theta = \frac{\sqrt{5}}{3}, \sin \theta = -\frac{2}{3}$

B) $\cos \theta = \frac{2}{3}, \sin \theta = \frac{\sqrt{5}}{3}$

✓ C) $\cos \theta = -\frac{2}{3}, \sin \theta = \frac{\sqrt{5}}{3}$

D) $\cos \theta = -\frac{\sqrt{5}}{3}, \sin \theta = \frac{2}{3}$

$$* \cos \theta = x \quad \text{الـ } x$$

$$= -\frac{2}{3}$$

$$* \sin \theta = y$$

$$\frac{\sqrt{5}}{3}$$

الـ y

4. $P\left(-\frac{4}{5}, -\frac{3}{5}\right)$

A) $\cos \theta = -\frac{3}{5}, \sin \theta = -\frac{4}{5}$

B) $\cos \theta = \frac{4}{5}, \sin \theta = -\frac{3}{5}$

C) $\cos \theta = \frac{3}{5}, \sin \theta = \frac{4}{5}$

✓ D) $\cos \theta = -\frac{4}{5}, \sin \theta = -\frac{3}{5}$

$$* \tan \theta = \frac{y}{x}$$

$$= \frac{-\frac{3}{5}}{-\frac{4}{5}}$$

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$$5. P\left(\frac{1}{6}, -\frac{\sqrt{35}}{6}\right)$$

$$A) \cos \theta = -\frac{\sqrt{35}}{6}, \sin \theta = \frac{1}{6}$$

$$\checkmark B) \cos \theta = \frac{1}{6}, \sin \theta = -\frac{\sqrt{35}}{6}$$

$$C) \cos \theta = \frac{\sqrt{35}}{6}, \sin \theta = \frac{1}{6}$$

$$D) \cos \theta = -\frac{1}{6}, \sin \theta = \frac{\sqrt{35}}{6}$$

$$6. P\left(\frac{\sqrt{7}}{4}, \frac{3}{4}\right)$$

$$A) \cos \theta = \frac{3}{4}, \sin \theta = \frac{\sqrt{7}}{4}$$

$$B) \cos \theta = \frac{\sqrt{7}}{4}, \sin \theta = -\frac{3}{4}$$

$$C) \cos \theta = -\frac{\sqrt{7}}{4}, \sin \theta = \frac{3}{4}$$

$$\checkmark D) \cos \theta = \frac{\sqrt{7}}{4}, \sin \theta = \frac{3}{4}$$

$$p = \frac{2\pi}{b}$$

Q18-MCQ 9-4

$$f = \frac{1}{p}$$

Example 5 Characteristics of the Sine and Cosine Functions

$$a = 40, b = \pi$$

SPRINGS An object on a spring oscillates according to the function $y = 40 \cos \pi t$, where y is the distance in centimeters above its equilibrium position at time t in seconds. Find the period and frequency,

$$A. P = 2, F = 5$$

$$B. P = 1, F = 5$$

$$\checkmark C. P = 2, F = 0.5$$

$$D. P = 0.5, F = 2$$

$$* \text{Period} = \frac{2\pi}{b} = \frac{2\pi}{\pi} = 2$$

$$* F = \frac{1}{p} = \frac{1}{2} = 0.5$$



ELECTRONICS The electric power delivered for household use in the United States is 110 volts. The function $y = 100\sqrt{2} \sin 120\pi t$ represents the effective current, where t is the time in seconds.

Find the period and frequency,

A. $P = 2$, $F = 5$

✓ B. $P = 1/60$, $F = 60$

C. $P = 2$, $F = 0.5$

D. $P = 0.5$, $F = 2$

$$a = 100\sqrt{2}, b = 120\pi$$

$$* P = \frac{2\pi}{b} = \frac{2\pi}{120\pi}$$

$$= \frac{1}{60}$$

$$* F = \frac{1}{P} = \frac{1}{\frac{1}{60}} = 60$$

Example 6 Model Periodic Situations

ELECTRICITY The voltage supplied by an electrical outlet can be represented by a periodic function. The voltage oscillates **between -120 and 120** volts, with a **frequency** of 50 cycles per second. Write and graph a function for the voltage v as a function of time t .

✓ A) $v(t) = 120 \sin(100\pi t)$

B) $v(t) = 120 \cos(100\pi t)$

C) $v(t) = 120 \sin(50\pi t)$

D) $v(t) = 120 \cos(50\pi t)$

$$y = a \sin bt$$

$$* a = \frac{\text{max} - \text{mini}}{2}$$

$$a = \frac{120 - (-120)}{2} = 120$$

$$* b = 2\pi \times \text{Frequency}$$

$$= 2\pi \times 50$$

$$y = 120 \sin 100\pi t \quad \leftarrow = 100\pi$$



17. **USE A MODEL** An object on a spring oscillates using the function $y = 25 \cos \pi t$, where y is the distance in inches from its equilibrium position in t seconds.

a. Find and describe the period and frequency.

$$a = 25, \quad b = \pi$$

b. Identify the domain and range in the context of the situation.

A) $P = 2 \text{ s}, f = 0.5 \text{ Hz}, \text{ Domain: } t \geq 0, \text{ Range: } -25 \leq y \leq 25$

B) $P = 1 \text{ s}, f = 1 \text{ Hz}, \text{ Domain: } t \geq 0, \text{ Range: } -25 \leq y \leq 25$

C) $P = \pi \text{ s}, f = \frac{1}{\pi} \text{ Hz}, \text{ Domain: } t \geq 0, \text{ Range: } -25 \leq y \leq 25$

D) $P = 2\pi \text{ s}, f = \frac{1}{2\pi} \text{ Hz}, \text{ Domain: } t \geq 0, \text{ Range: } -25 \leq y \leq 25$

$$*P = \frac{2\pi}{b} = \frac{2\pi}{\pi} = 2$$

$$*f = \frac{1}{P} = \frac{1}{2} = 0.5$$

$$* \text{domain} = h = 0 \rightarrow t \geq 0$$

$$* \text{Range} \quad -a \leq t \leq a$$

$$-25 \leq t \leq 25$$

18. **SWINGS** Suppose a tire swing is rotated $\frac{\pi}{5}$ radians and released. The function $y = \frac{\pi}{5} \cos 2t$ represents the displacement of the swing at time t for a frequency of radians per second.

$$a = \frac{\pi}{5}$$

a. Find the period and frequency, and describe them in the context of the situation.

$$b = 2$$

b. Identify the domain and range in the context of the situation.

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- ✓ A) $P = \pi$ s, $f = \frac{1}{\pi}$ Hz, Domain: $t \geq 0$, Range: $-\frac{\pi}{5} \leq y \leq \frac{\pi}{5}$
 B) $P = 2\pi$ s, $f = \frac{1}{2\pi}$ Hz, Domain: $t \geq 0$, Range: $-\frac{\pi}{5} \leq y \leq \frac{\pi}{5}$
 C) $P = 1$ s, $f = 1$ Hz, Domain: $t \geq 0$, Range: $-\frac{\pi}{5} \leq y \leq \frac{\pi}{5}$
 D) $P = \frac{\pi}{2}$ s, $f = \frac{2}{\pi}$ Hz, Domain: $t \geq 0$, Range: $-\frac{\pi}{5} \leq y \leq \frac{\pi}{5}$

$$* P = \frac{2\pi}{b} = \frac{2\pi}{2} = \pi$$

$$* F = \frac{1}{P} = \frac{1}{\pi}$$

$$* D \quad t \geq 0$$

$$* \text{Range} \quad -a \leq t \leq a \rightarrow -\frac{\pi}{5} \leq t \leq \frac{\pi}{5}$$

19. **REASONING** A boat that is tied to a dock moves vertically up and down with the waves. Delray watches the boat for 30 seconds and notes that the boat moves up and down a total of 6 times. The difference between the boat's highest point and lowest point is 3 feet. Write and graph a trigonometric function that models the boat's vertical position x seconds after she began watching. Assume that when Delray began watching the boat, it was at its highest point and that its average vertical position was 0 feet.

$$y = a \cos bt$$

$$A) y = 1.5 \cos \left(\frac{\pi}{5} t \right)$$

$$* a = \frac{3}{2} = 1.5$$

$$B) y = 3 \cos \left(\frac{\pi}{5} t \right)$$

$$* P = \frac{\text{Seconds}}{\text{Times}} = \frac{30}{6} = 5$$

$$✓ C) y = 1.5 \cos \left(\frac{\pi}{2.5} t \right)$$

$$D) y = 3 \cos \left(\frac{\pi}{2.5} t \right)$$

$$b = \frac{2\pi}{P} = \frac{2\pi}{5} = \frac{1\pi}{2.5}$$

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20. **FERRIS WHEELS** A Ferris wheel at a state fair has a diameter of 65 feet and makes 4 complete revolutions each minute. Santiago boards a car of the Ferris wheel at the car's lowest point, and he rides for 2 minutes. Write and graph a trigonometric function that models his height above or below the axle of the Ferris wheel θ minutes after the ride starts.



A) $h(\theta) = 32.5 \cos(8\pi\theta) - 32.5$

B) $h(\theta) = -32.5 \cos(8\pi\theta)$

C) $h(\theta) = 32.5 \sin(8\pi\theta) - 32.5$ α

D) $h(\theta) = 32.5 \sin(8\pi\theta) + 32.5$ α

* $a = \frac{65}{2} = 32.5$

* $p = \frac{1}{4} = 0.25$

* $b = \frac{2\pi}{p}$

$b = \frac{2\pi}{0.25} = 8\pi$

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$$y = a \cos(bx + c) + d$$

Q19-MCQ 9-6

$$y = a \sin(bx + c) + d$$

State the amplitude, period, phase shift, vertical shift, and midline equation of each function. Then graph the function and state the domain and range.

$$13. y = \cos \theta + 3 \quad a = 1, b = 1, c = 0, d = 3$$

$$A. \text{Amp}=1, \text{Period}=2\pi, \text{PS}=0, \text{VS}=3, \text{Midline } y = 3, \text{Domain}=\mathbb{R}, \text{Range}=[2,4]$$

$$B. \text{Amp}=1, \text{Period}=\pi, \text{PS}=0, \text{VS}=3, \text{Midline } y = 3, \text{Domain}=\mathbb{R}, \text{Range}=[2,4]$$

$$C. \text{Amp}=1, \text{Period}=2\pi, \text{PS}=0, \text{VS}=0, \text{Midline } y = 0, \text{Domain}=\mathbb{R}, \text{Range}=[-1,1]$$

$$D. \text{Amp}=1, \text{Period}=2\pi, \text{PS}=0, \text{VS}=3, \text{Midline } y = 3, \text{Domain}=\theta \neq \frac{\pi}{2} + n\pi, \text{Range}=\mathbb{R}$$

$$* \text{Amplitude} = |a| = |1| = 1$$

$$* \text{Period} = \frac{2\pi}{b} = \frac{2\pi}{1} = 2\pi$$

$$* \text{phase shift} = \frac{-c}{b} = \frac{0}{1} = 0$$

$$* \text{Vertical shift} = d = 3 \text{ up}$$

$$* \text{midline} \rightarrow y = d \rightarrow \boxed{y = 3}$$

$$* D = \mathbb{R}$$

$$* \text{Range} \quad -a + d \leq y \leq a + d \quad | \quad 2 \leq y \leq 4$$

$$\quad -1 + 3 \leq y \leq 1 + 3$$

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14. $y = \tan \theta - 1$  $y = a \tan(bx + c) + d$

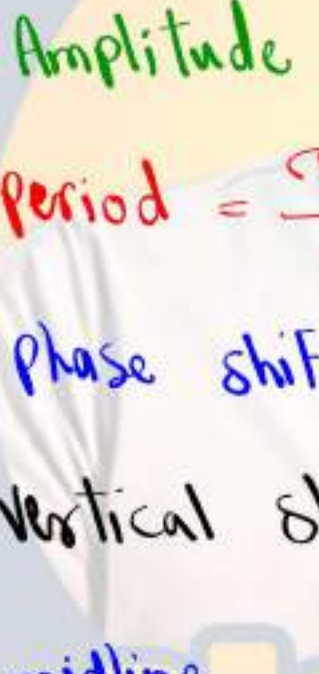
(A) Amp=undefined, Period= π , PS=0, VS=-1, Midline $y = -1$, Domain= $\theta \neq \frac{\pi}{2} + n\pi$, Range= $\mathbb{R}$

B. Amp=1, Period= π , PS=0, VS=-1, Midline $y = -1$, Domain= $\mathbb{R}$, Range= $[-2, 0]$ α

C. Amp=undefined, Period= 2π , PS=0, VS=-1, Midline $y = -1$, Domain= $\mathbb{R}$, Range= $\mathbb{R}$ α

D. Amp=undefined, Period= π , PS=0, VS=1, Midline $y = 1$, Domain= $\theta \neq \frac{\pi}{2} + n\pi$, Range= $\mathbb{R}$ α

$a = 1$, $b = 1$, $c = 0$, $d = -1$

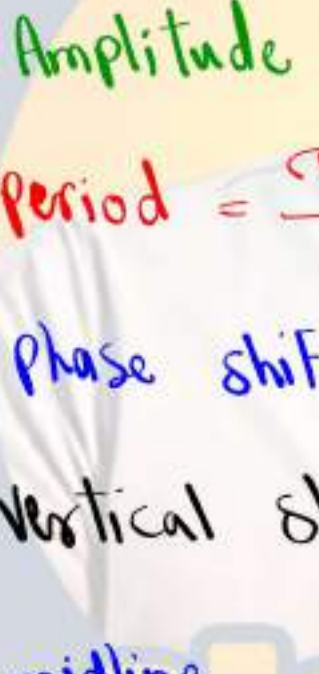
* Amplitude (None)  دالةً لا يوجد

* Period = $\frac{\pi}{b} = \frac{\pi}{1} = \pi$

* Phase shift (None) = $\frac{-c}{b} = \frac{0}{1} = 0$

* Vertical shift = $d = -1$ down

* midline $y = d \rightarrow |y = -1|$

* $\theta \neq \frac{\pi}{2} + \pi n$  ثابت

* Range $-\infty \leq y \leq \infty$ or $\mathbb{R}$

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$$15. y = \tan \theta + \frac{1}{2}$$

$$y = a \tan (bx + c) + d$$

(A) Amp=undefined, Period= π , PS=0, VS= $\frac{1}{2}$, Midline $y = \frac{1}{2}$, Domain= $\theta \neq \frac{\pi}{2} + n\pi$, Range= $\mathbb{R}$

B. Amp=1, Period= π , PS=0, VS= $\frac{1}{2}$, Midline $y = \frac{1}{2}$, Domain= $\mathbb{R}$, Range= $[-0.5, 1.5]$

C. Amp=undefined, Period= 2π , PS=0, VS= $\frac{1}{2}$, Midline $y = \frac{1}{2}$, Domain= $\mathbb{R}$, Range= $\mathbb{R}$

D. Amp=undefined, Period= π , PS=0, VS= $-\frac{1}{2}$, Midline $y = -\frac{1}{2}$, Domain= $\theta \neq \frac{\pi}{2} + n\pi$, Range= $\mathbb{R}$

$$a = 1, b = 1, c = 0, d = \frac{1}{2}$$

* None Amplitude

$$* \text{Period} = \frac{\pi}{b} = \frac{\pi}{1} = \pi$$

$$* \text{phase shift} = \frac{-c}{b} = \frac{0}{1} = 0$$

$$* \text{Vertical shift} = d = \frac{1}{2} \text{ up}$$

$$* \text{midline } y = d \rightarrow \boxed{y = \frac{1}{2}}$$

$$* D \neq \boxed{\frac{\pi}{2} + n\pi} \text{ or } \boxed{90 + 180n}$$

$$* \text{Range } -\infty \leq y \leq \infty \text{ or } (-\infty, \infty) \text{ or } \mathbb{R}$$

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$$16. y = 2 \cos \theta - 5$$

$$y = a \cos (bx + c) + d$$

A. Amp=2, Period= 2π , PS=0, VS=-5, Midline $y = -5$, Domain= $\mathbb{R}$, Range= $[-7, -3]$

B. Amp=2, Period= π , PS=0, VS=-5, Midline $y = -5$, Domain= $\mathbb{R}$, Range= $[-7, -3]$

C. Amp=2, Period= 2π , PS=0, VS=5, Midline $y = 5$, Domain= $\mathbb{R}$, Range= $[3, 7]$

D. Amp=2, Period= 2π , PS=0, VS=-5, Midline $y = -5$, Domain= $\theta \neq \frac{\pi}{2} + n\pi$, Range= $\mathbb{R}$

$$a = 2, \quad b = 1, \quad c = 0, \quad d = -5$$

$$* \text{Amplitude} = |a| = |2| = 2$$

$$* \text{Period} = \frac{2\pi}{b} = \frac{2\pi}{1} = 2\pi$$

$$* \text{Phase shift} = \frac{-c}{b} = \frac{0}{1} = 0$$

$$* \text{Vertical shift} = d = -5 \text{ down}$$

$$* \text{mid line } y = d \rightarrow y = -5$$

$$* D = \mathbb{R} = (-\infty, \infty)$$

$$* \text{Range } -a+d \leq y \leq a+d \quad | \quad -7 \leq y \leq -3$$

$$-2-5 \leq y \leq 2-5 \quad | \quad [-7, -3]$$

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$$17. y = 2 \sin \theta - 4$$

$$y = a \sin (bx + c) + d$$

A. Amp=2, Period= 2π , PS=0, VS=-4, Midline $y = -4$, Domain= $\mathbb{R}$, Range= $[-6, -2]$

B. Amp=2, Period= π , PS=0, VS=-4, Midline $y = -4$, Domain= $\mathbb{R}$, Range= $[-6, -2]$

C. Amp=2, Period= 2π , PS=0, VS=4, Midline $y = 4$, Domain= $\mathbb{R}$, Range= $[2, 6]$ α

D. Amp=2, Period= 2π , PS=0, VS=-4, Midline $y = -4$, Domain= $\theta \neq \frac{\pi}{2} + n\pi$, Range= $\mathbb{R}$ α

$$a = 2, \quad b = 1, \quad c = 0, \quad d = -4$$

$$* \text{Amplitude} = |a| = |2| = 2$$

$$* \text{Period} = \frac{2\pi}{b} = \frac{2\pi}{1} = 2\pi$$

$$* \text{Phase Shift} = \frac{-c}{b} = \frac{0}{1} = 0$$

$$* \text{Vertical Shift} = d = -4 \text{ down}$$

$$* \text{midline } y = d \rightarrow |y = -4|$$

$$* \text{Domain} = \mathbb{R} = (-\infty, \infty)$$

$$* \text{Range } -a + d \leq y \leq a + d \quad | \quad -6 \leq y \leq -2$$

$$-2 - 4 \leq y \leq 2 - 4 \quad | \quad \text{or } [-6, -2]$$

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$$18. y = \frac{1}{3} \sin \theta + 7$$

$$y = a \sin(bx + c) + d$$

A. Amp = $\frac{1}{3}$, Period = 2π , PS = 0, VS = 7, Midline $y = 7$, Domain = $\mathbb{R}$, Range = $[\frac{20}{3}, \frac{22}{3}]$

B. Amp = 3, Period = 2π , PS = 0, VS = 7, Midline $y = 7$, Domain = $\mathbb{R}$, Range = $[4, 10]$

C. Amp = $\frac{1}{3}$, Period = π , PS = 0, VS = 7, Midline $y = 7$, Domain = $\mathbb{R}$, Range = $[\frac{20}{3}, \frac{22}{3}]$

D. Amp = $\frac{1}{3}$, Period = 2π , PS = 0, VS = 7, Midline $y = 7$, Domain = $\theta \neq \frac{\pi}{2} + n\pi$, Range = $\mathbb{R}$

$$a = \frac{1}{3}, b = 1, c = 0, d = 7$$

* Amplitude = $|\frac{1}{3}| = \frac{1}{3}$

* Period = $\frac{2\pi}{b} = \frac{2\pi}{1} = 2\pi$

* Phase shift = $-\frac{c}{b} = \frac{0}{1} = 0$

* Vertical shift = $d = 7$ up

* midline $y = d \rightarrow \boxed{y = 7}$

* D = $\mathbb{R} = (-\infty, \infty)$

* Range $-a + d \leq y \leq a + d \mid \frac{20}{3} \leq y \leq \frac{22}{3}$
 $-\frac{1}{3} + 7 \leq y \leq \frac{1}{3} + 7 \mid \text{or } [\frac{20}{3}, \frac{22}{3}]$



Q20-MCQ 9-7

Example 1 Evaluate Inverse Trigonometric Functions

Find $\tan^{-1} \sqrt{3}$. Write angle measures in degrees and radians.

A. $60^\circ, \frac{\pi}{3}$

B. $45^\circ, \frac{\pi}{4}$

C. $30^\circ, \frac{\pi}{6}$

D. $90^\circ, \frac{\pi}{2}$

* arc tan = $\tan^{-1}$

→ Shift → $\tan(\sqrt{3})$
= 60°

* Radian * Shift → Mode → 2 → 2
 $\frac{\pi}{3}$

1. $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$

* degree

Shift → Mode → 2 → 1

A. $45^\circ, \frac{\pi}{4}$

30

B. $30^\circ, \frac{\pi}{6}$

C. $90^\circ, \frac{\pi}{2}$

D. $60^\circ, \frac{\pi}{3}$

* Radian

Shift → Mode → 2 → 2

$\frac{\pi}{6}$

2. $\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)$

* degree

Shift → Mode → 2 → 1

A. $-60^\circ, -\frac{\pi}{3}$

B. $-45^\circ, -\frac{\pi}{4}$

C. $-30^\circ, -\frac{\pi}{6}$

D. $-90^\circ, -\frac{\pi}{2}$

* Radian

Shift → Mode → 2 → 2

$-\frac{\pi}{3}$

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3. $\text{Arccos}\left(-\frac{1}{2}\right)$ * degree Shift → Mode → 2 → 1

A. $135^\circ, \frac{3\pi}{4}$

B. $150^\circ, \frac{5\pi}{6}$

☒ C. $120^\circ, \frac{2\pi}{3}$

D. $90^\circ, \frac{\pi}{2}$

* Radian Shift → Mode → 2 → 2

$\frac{2\pi}{3}$

4. $\text{Arctan}\sqrt{3}$

* degree → Shift → Mode → 2 → 1

A. $45^\circ, \frac{\pi}{4}$

☒ B. $60^\circ, \frac{\pi}{3}$

C. $30^\circ, \frac{\pi}{6}$

D. $120^\circ, \frac{2\pi}{3}$

* Radian → Shift → Mode → 2 → 2

$\frac{\pi}{3}$

5. $\text{Arccos}\left(-\frac{\sqrt{2}}{2}\right)$ * degree Shift → Mode → 2 → 1

A. $120^\circ, \frac{2\pi}{3}$

B. $150^\circ, \frac{5\pi}{6}$

☒ C. $135^\circ, \frac{3\pi}{4}$

D. $225^\circ, \frac{5\pi}{4}$

$\cos^{-1}\left(-\frac{\sqrt{2}}{2}\right) = 135$

* Radian Shift → Mode → 2 → 2

$\frac{3\pi}{4}$

6. $\text{Tan}^{-1}(-1)$

* degree Shift → Mode → 2 → 1

☒ A. $-45^\circ, -\frac{\pi}{4}$

B. $-30^\circ, -\frac{\pi}{6}$

C. $-60^\circ, -\frac{\pi}{3}$

D. $-90^\circ, -\frac{\pi}{2}$

* Radian Shift → Mode → 2 → 2

$-\frac{\pi}{4}$

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7. $\sin^{-1} \frac{\sqrt{2}}{2}$

* degree Shift $\rightarrow$ Mode $\rightarrow 2 \rightarrow 1$

A. $60^\circ, \frac{\pi}{3}$

45

✓ B. $45^\circ, \frac{\pi}{4}$

* Radian Shift $\rightarrow$ Mode $\rightarrow 2 \rightarrow 2$

C. $30^\circ, \frac{\pi}{6}$

D. $90^\circ, \frac{\pi}{2}$

 $\frac{\pi}{4}$

8. $\cos^{-1} \left(-\frac{\sqrt{3}}{2} \right)$

* degree Shift $\rightarrow$ Mode $\rightarrow 2 \rightarrow 1$

✓ A. $150^\circ, \frac{5\pi}{6}$

150

B. $120^\circ, \frac{2\pi}{3}$

* Radian Shift $\rightarrow$ Mode $\rightarrow 2 \rightarrow 2$

C. $135^\circ, \frac{3\pi}{4}$

D. $90^\circ, \frac{\pi}{2}$

 $\frac{5\pi}{6}$

9. $\arcsin 1$

* $\sin^{-1} 1 = 90$

✓ A. $90^\circ, \frac{\pi}{2}$

B. $60^\circ, \frac{\pi}{3}$

C. $45^\circ, \frac{\pi}{4}$

D. $30^\circ, \frac{\pi}{6}$

* $\sin^{-1} 1 = \frac{\pi}{2}$ طارق علي
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الجزء الكتابي

Q21-FRQ 5-2

Solve each equation.

1. $25^{2x+3} = 25^{5x-9}$

$$2x+3 = 5x-9$$

$$2x - 5x = -9 - 3$$

$$-3x = -12$$

$$x = \frac{-12}{-3}$$

$$\rightarrow \boxed{x = 4}$$

2. $9^{8x-4} = 81^{3x+6}$

$$8x-4 = 2(3x+6)$$

$$8x-4 = 6x+12$$

$$8x-6x = 12+4$$

$$2x = 16$$

$$x = \frac{16}{2} = \boxed{8}$$

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$$3. \quad 4^{x-5} = 16^{2x-31}$$

$$\begin{array}{ccc} x-5 & & 2(2x-31) \\ 4 & = & 4 \end{array}$$

$$x-5 = 4x-62$$

$$x-4x = -62+5$$

$$-3x = -57$$

$$x = \frac{-57}{-3}$$

$$| x = 19 |$$

$$4. \quad 4^{3x-3} = 8^{4x-4}$$

8

$$\begin{array}{ccc} 2(3x-3) & & 3(4x-4) \\ 2 & = & 2 \end{array}$$

$$6x-6 = 12x-12$$

$$6x-12x = -12+6$$

$$-6x = -6$$

$$x = \frac{-6}{-6} = 1$$

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5. $9^{-x+5} = 27^{6x-10}$

188

$$\frac{2(-x+5)}{\cancel{3}} = \frac{3(6x-10)}{\cancel{3}}$$

$$2(-x+5) = 3(6x-10)$$

$$-2x + 10 = 18x - 30$$

$$-2x - 18x = -30 - 10$$

$$-20x = -40$$

$$x = \frac{-40}{-20}$$

$$\boxed{x = 2}$$

6. $125^{3x-4} = 25^{4x+2}$

$$\frac{3(3x-4)}{\cancel{5}} = \frac{2(4x+2)}{\cancel{5}}$$

$$9x - 12 = 8x + 4$$

$$9x - 8x = 4 + 12$$

$$\boxed{x = 16}$$



Q22-FRQ 6-2

Solve each equation.

$$7. \log_4(2x^2 - 4) = \log_4 2x$$

$$2x^2 - 4 = 2x$$

$$2x^2 - 2x - 4 = 0 \Rightarrow 2[x^2 - x - 2] = 0$$

$$(x - 2)(x + 1) = 0$$

$$x = 2 \quad , \quad x = -1$$

* check at $x = 2$

$$\log_4(2(2)^2 - 4) \stackrel{?}{=} \log_4 2(2)$$

$$\log_4(4) = \log_4(4)$$

+ = ✓

* at $x = -1$

$$\log_4(2(-1)^2 - 4) \stackrel{?}{=} \log_4 2(-1)$$

$$\log_4(-2) = \log_4(-2)$$

مرفوض (-)

only solution {2}

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$$8. \log_5 (x^2 - 6) = \log_5 x$$

$$x^2 - 6 = x$$

$$x^2 - x - 6 = 0$$

$$(x+2)(x-3) = 0$$

$$x = -2 \quad | \quad x = 3$$

* check

$$|x = -2|$$

$$\log_5 (-2)^2 - 6$$

$$= \log_5 (-2) \quad \alpha$$

* at $x = 3$

$$\log_5 3^2 - 6 = \log_5 3$$

$$\log_5 3 = \log_5 3 + 1 = \checkmark$$

only solution $\{3\}$

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$$10. \log_4 (2x^2 - 20) = \log_4 6x$$

$$2x^2 - 20 = 6x$$

$$2x^2 - 6x - 20 = 0$$

$$2[x^2 - 3x - 10] = 0$$

$$(x - 5)(x + 2) = 0$$

$$x = 5, \quad x = -2$$

* check at $x = 5$

$$\log_4 (2(5)^2 - 20) \stackrel{?}{=} \log_4 6(5)$$

$$\log_4 30 = \log_4 30 \quad +1 = \checkmark$$

* at $x = -2$

$$\log_4 (2(-2)^2 - 20) \stackrel{?}{=} \log_4 6(-2)$$

$$\log_4 (-12) = \log_4 (-12) \quad \alpha$$

only solution $|x = 5|$

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Use $\log_4 2 = 0.5$, $\log_4 3 \approx 0.7925$, and $\log_4 5 \approx 1.1610$ to approximate the value of each expression.

$$13. \log_4 30 = \log_4 (10 \times 3) = \log_4 (2 \times 5 \times 3)$$

$$\log_4 2 + \log_4 3 + \log_4 5 =$$

$$0.5 + 0.7925 + 1.1610 = 2.4535$$

Use $\log_4 2 = 0.5$, $\log_4 3 \approx 0.7925$, and $\log_4 5 \approx 1.1610$ to approximate the value of each expression.

$$14. \log_4 20 = \log_4 (5 \times 4)$$

$$= \log_4 (5 \times 2 \times 2)$$

$$= \log_4 5 + \log_4 2 + \log_4 2$$

$$= \log_4 5 + 2 \log_4 2$$

$$1.1610 + 2(0.5) = 2.1610$$

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Use $\log_4 2 = 0.5$, $\log_4 3 \approx 0.7925$, and $\log_4 5 \approx 1.1610$ to approximate the value of each expression.

$\div \rightarrow -$

15. $\log_4 \frac{2}{3}$

$$\log_4 2 - \log_4 3 = 0.5 - 0.7925 = -0.2925$$

16. $\log_4 \frac{4}{3} = \log_4 4 - \log_4 3$

$$= \log_4 2^2 - \log_4 3 = 2\log_4 2 - \log_4 3$$

$$= 2(0.5) - 0.7925 = 0.2075$$

17. $\log_4 9 = \log_4 3^2$

$$= 2\log_4 3$$

$$= 2(0.7925) = 1.5850$$

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Use $\log_2 3 \approx 1.5850$ and $\log_2 5 \approx 2.3219$ to approximate the value of each expression.

$$19. \log_2 25 = \log_2 5^2 = 2 \log_2 5$$

$$= 2(2.3219) = 4.6438$$

Use $\log_2 3 \approx 1.5850$ and $\log_2 5 \approx 2.3219$ to approximate the value of each expression.

$$20. \log_2 27 = \log_2 3^3$$

$$= 3 \log_2 3 = 3(1.5850)$$

$$= 4.755$$

Use $\log_2 3 \approx 1.5850$ and $\log_2 5 \approx 2.3219$ to approximate the value of each expression.

$$21. \log_2 125 = \log_2 5^3 = 3 \log_2 5$$

$$= 3(2.3219)$$

$$= 6.9657$$

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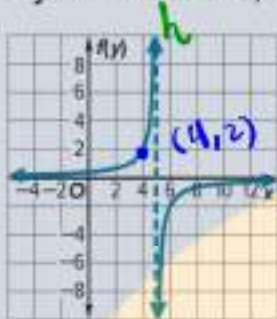
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Q23-FRQ 7-3

Identify the values of a , h , and k . Then write a function for the graph $g(x) = \frac{a}{x-h} + k$.

17.



$$* h = 5$$

$$g(x) = \frac{a}{x-5} + 0$$

$$* k = 0$$

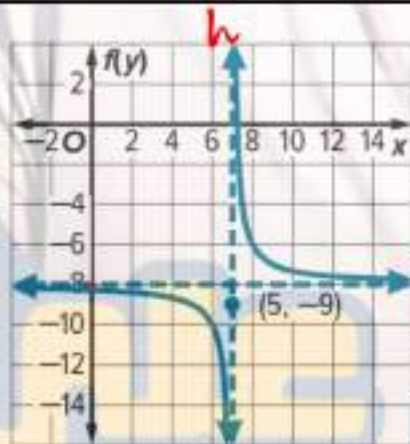
* any point (4, 2)

$$2 = \frac{a}{4-5} \rightarrow 2 = \frac{a}{-1} \quad \text{cross}$$

$$a = 2(-1) = -2$$

$$g(x) = \frac{-2}{x-5}$$

18.



$$* h = 7, k = -8$$

$$g(x) = \frac{a}{x-h} + k$$

$$g(x) = \frac{a}{x-7} - 8$$

$$* (5, -9) \Rightarrow -9 = \frac{a}{5-7} - 8$$

$$-9 + 8 = \frac{a}{-2}$$

$$-1 = \frac{a}{-2} \rightarrow a = (-1)(-2) = 2$$

$$g(x) = \frac{2}{x-7} - 8$$

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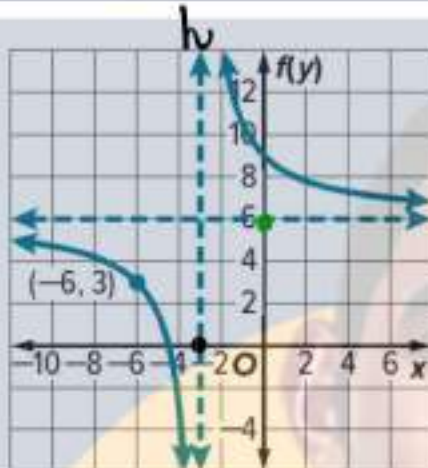
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19.



$$* h = -3, k = 6$$

$$g(x) = \frac{a}{x-h} + k$$

$$g(x) = \frac{a}{x+3} + 6$$

$$* (-6, 3) \rightarrow 3 = \frac{a}{-6+3} + 6$$

$$3-6 = \frac{a}{-3} \rightarrow -3 = \frac{a}{-3}$$

$$a = (-3)(-3) = 9 \rightarrow g(x) = \frac{9}{x+3} + 6$$

20.



$$* h = -3, k = 0$$

$$g(x) = \frac{a}{x-h} + k$$

$$= \frac{a}{x+3}$$

$$* (5, 1)$$

$$1 = \frac{a}{5+3} \rightarrow 1 = \frac{a}{8} \rightarrow a = 8$$

$$g(x) = \frac{8}{x+3}$$

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Q24-FRQ 8-4

Example 6 Use z-Values to Locate Position

Find z if $X = 24$, $\mu = 19$, and $\sigma = 3.8$.

$$z = \frac{x - \mu}{\sigma} = \frac{24 - 19}{3.8} = 1.32$$

Check

Find z if $X = 106.3$, $\mu = 88.8$, and $\sigma = 9.6$. Round your answer to the nearest thousandth. $z = \underline{\hspace{1cm}}$

$$z = \frac{x - \mu}{\sigma} = \frac{106.3 - 88.8}{9.6} = 1.82$$

Example 7 Find Area Under the Standard Normal Curve by Using a Table

Use a Standard Normal Distribution Table to find the area under the normal curve within the interval $z < -1.18$.

z	0.00	...	0.08	0.09
-3.4	0.0003	...	0.0003	0.0002
...	...	...	...	...
-1.1	0.1357	...	0.1190	0.1170

-1.18

-1.1

0.08

Vertical

Horizontal

$$P = 0.1190 \times 100\% = 11.9\% \approx 12\%$$



Example 8 Find Area Under the Standard Normal Curve by Using a Calculator

INTERNET TRAFFIC The number of daily hits to a local news Web site is normally distributed with $\mu = 98,452$ hits and $\sigma = 10,325$ hits. Find the probability that the Web site will get at least 100,000 hits on a given day, $P(X \geq 100,000)$. *more*

$$① Z = \frac{x - \mu}{\sigma} = \frac{100,000 - 98,452}{10,325}$$

$$Z = 0.150$$

② Mode $\rightarrow$ dist $\rightarrow$ normal cd $\left\{ \begin{array}{l} \text{lower } 0.150 \\ \text{upper } 4 \end{array} \right.$

$$P = 0.4403 \times 100\% \approx 44\%$$

mode $\downarrow$ dist $\rightarrow$ normal cd $\rightarrow$ lower = upper (قيد)

Find the z-value for each standard normal distribution.

8. $\sigma = 9.8$, $X = 55.4$, and $\mu = 68.34$

$$Z = \frac{55.4 - 68.34}{9.8} \approx -1.32$$

9. $\sigma = 11.6$, $X = 42.80$, and $\mu = 68.2$

$$Z = \frac{42.80 - 68.2}{11.6} \approx -2.19$$

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10. $\sigma = 11.9$, $X = 119.2$, and $\mu = 112.4$

$$Z = \frac{x - \mu}{\sigma} = \frac{119.2 - 112.4}{11.9} = 0.57$$

Use a table to find the area under the normal curve for each interval.11. $z > 0.58$ mode $\rightarrow$ dist $\rightarrow$ normal cd

lower 0.58

upper 4

$$P = 0.281 \times 100\% = 28.1\% \approx 28\%$$

12. $z < -1.56$

-4!

mode $\rightarrow$ dist $\rightarrow$ normal cd

lower -4

upper -1.56

$$P = 0.059 \times 100\% = 5.9\% \approx 6\%$$

13. $-2.29 < z < 2.76$ mode $\rightarrow$ dist $\rightarrow$ normal cd

lower -2.29

upper 2.76

$$P = 0.9861$$

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14. **TESTING** The scores on a test administered to prospective employees are normally distributed with a mean of 100 and a standard deviation of 12.3.

a. What percent of the scores are between 70 and 80?

$$\mu = 100, \sigma = 12.3, P(70 < x < 80)$$

$$* z_1 = \frac{70 - 100}{12.3}$$

$$z_2 = \frac{80 - 100}{12.3}$$

$$z_1 = -2.439$$

$$z_2 = -1.626$$

mode $\rightarrow$ dist $\rightarrow$ normal C.D

$$\text{lower} = -2.439$$

$$\text{upper} = -1.626$$

$$P = 0.0446 \times 100\% \\ = 4.46\% \approx 4.5\%$$

b. What percent of the scores are over 115?

$$P(x > 115)$$

$$z = \frac{115 - 100}{12.3} = 1.2195$$

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mode $\rightarrow$ dist $\rightarrow$ normal c.v

lower 1.2195

upper 4

 $\begin{matrix} > \text{mode} \\ 4 \end{matrix}$

$$P = 0.1112 \times 100\% = 11.1\% \approx 11\%$$

c. If 75 people take the test, how many would you expect to score lower than 75?

$$P(x < 75)$$

$$* Z = \frac{75 - 100}{12.3} = \boxed{-2.0325}$$

 $\begin{matrix} \text{less} & -2 \\ & -4 \end{matrix}$
* mode $\rightarrow$ dist $\rightarrow$ normal c.v

lower -4

upper -2.0325

$$P = 0.021 \times 100\%$$

$$= 2.1\%$$

$$\approx 2\%$$

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Q25-FRQ 9-5

Example 1 Graph a Tangent Function with a Dilation

Find the period, asymptotes, x-intercepts, midline, and transformations of $y = \tan 3x$. Then graph the function.

$$\frac{180}{3} = 60$$

$$a=1, \quad b=3, \quad c=0, \quad d=0$$

$$* \text{Period} = \frac{\pi}{|b|} = \frac{\pi}{3} \quad \text{or} \quad 60$$

$$* \text{Asym } x = \frac{90 + 180n}{|b|} = \frac{90 + 180n}{3}$$

$$x = \frac{90}{3} + \frac{180n}{3} = 30 + 60n$$

* x-intercept = multiples of period
 $n = 0, \pm 1, \pm 2, \pm 3$

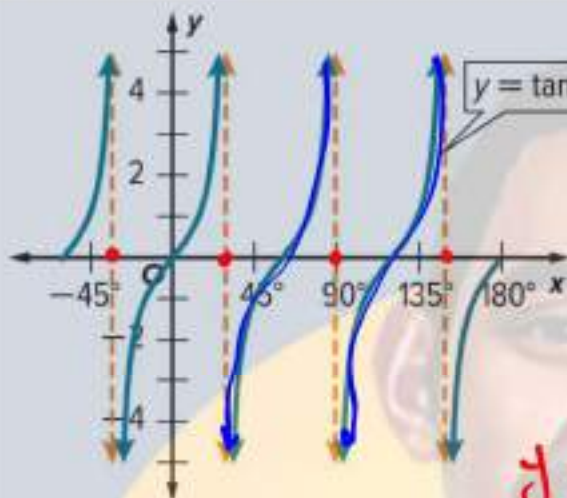
$$x = n \frac{\pi}{3} = 0, \pm \frac{\pi}{3}, \pm \frac{2\pi}{3}, \pm \pi$$

$$\text{or } x = 0, \pm 60, \pm 120, \pm 180$$

$$* \text{midline } y = d \quad y = 0$$

$$* \text{Transformation } y = \tan 3x$$

$b=3 > 1$ (inside) compressed horizontally



$$* \text{Asym} = 30 + 60n$$

$$n = 0, \pm 1, \pm 2, \pm 3$$

Asym V-A

$$x = 30, 90, 150, -30$$

$$y = \tan 3x \rightarrow a+$$

Example 2 Graph a Tangent Function with a Dilation and a Reflection

$$a = -\frac{1}{3}, \quad b = 2, \quad c = 0$$

Find the period, asymptotes, x-intercepts, midline, and transformations of $y = -\frac{1}{3} \tan 2x$. Then graph the function.

$$* \text{Period} = \frac{\pi}{|b|} = \frac{\pi}{2} \quad \text{or} \quad 90$$

$$* \text{Asym} \Rightarrow x = \frac{90 + 180n}{|b|} = \frac{90 + 180n}{2}$$

$$x = \frac{90}{2} + \frac{180n}{2} = [45 + 90n]$$

$$n = 0, \pm 1, \pm 2, \pm 3, \dots$$

* x-intercept $\rightarrow$ multiples of Period

$$x = n \cdot \frac{\pi}{2} \quad n = 0, \pm 1, \pm 2, \dots$$

$$x = 0, \pm \frac{\pi}{2}, \pm \pi$$

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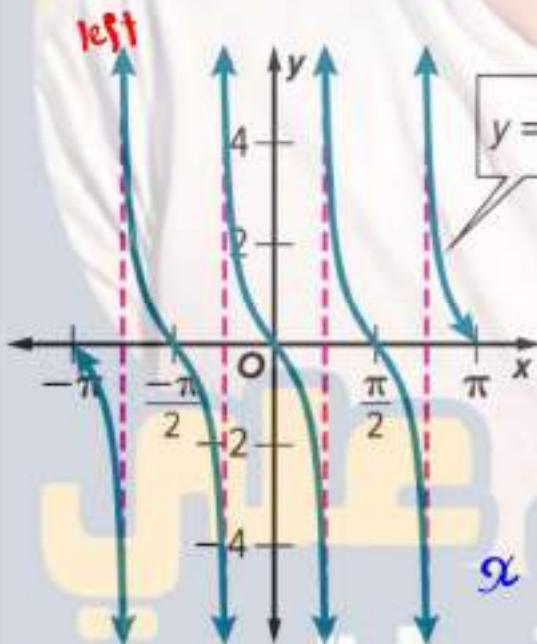
*midline $y = d \rightarrow y = 0$

* Transformation $y = -\frac{1}{3} \tan 2x$

(-) $\Rightarrow$ Reflection across x -axis

$a = \frac{1}{3} < 1$ (out) Compressed Vertically.

$b = 2 > 1$ (inside) Compressed Horizontally.



$$y = -\frac{1}{3} \tan 2x$$

$\rightarrow a -$

Asym = $45^\circ + 90^\circ n$

$n = 0, \pm 1, \pm 2, \pm 3$

$x = \pm 45^\circ, \pm 135^\circ, \pm 225^\circ$

$\pm \frac{11\pi}{4}, \pm \frac{3\pi}{4}, \pm \frac{5\pi}{4}$

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Find the period, asymptotes, x-intercepts, midline, and transformations of each tangent function. Then graph the function.

1. $y = \tan 5x$

$a=1, b=5, c=0, d=0$

* Period = $\frac{\pi}{|b|} = \frac{\pi}{5}$

* Asym $x = \frac{90 + 180n}{|b|} = \frac{90 + 180n}{5}$

$\frac{90}{5} + \frac{180n}{5} = |18 + 36n|$

* x-intercept $x = n \text{ period} = \frac{n\pi}{5}$

$n = 0, \pm 1, \pm 2, \pm 3, \dots$

$x = 0, \pm \frac{\pi}{5}, \pm \frac{2\pi}{5}$

* midline $y = d \rightarrow y = 0$

* Transformation :- $y = \tan 5x$

$b=5 > 1$ (inside) compressed

Horizontally

* graph a +

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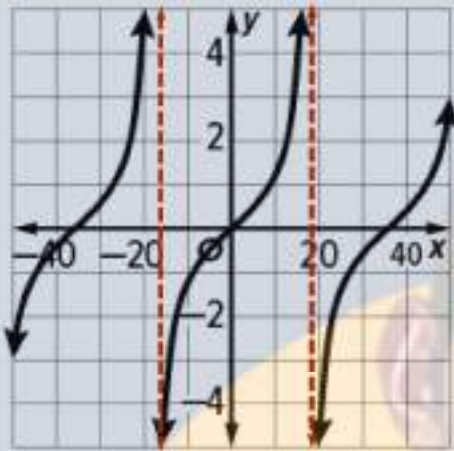
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$$3. y = \tan 2x$$

$$\frac{\pi}{b} = \frac{180}{b}$$

$$a = 1, \quad b = 2, \quad c = 0, \quad d = 0$$

$$* \text{Period} = \frac{180}{|b|} = \frac{180}{2} = \underline{90}$$

$$* \text{Asym } x = \frac{90 + 180n}{b} = \frac{90 + 180n}{2}$$

$$x = \frac{90}{2} + \frac{180n}{2} \quad | x = 45 + 90n |$$

$$* x\text{-intercept} \Rightarrow x = n \text{ Period} = 90n$$

$$n = 0, \pm 1, \pm 2, \pm 3$$

$$x = 0, \pm 90, \pm 180, \pm 270$$

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* midline

$$y = d \rightarrow y = 0$$

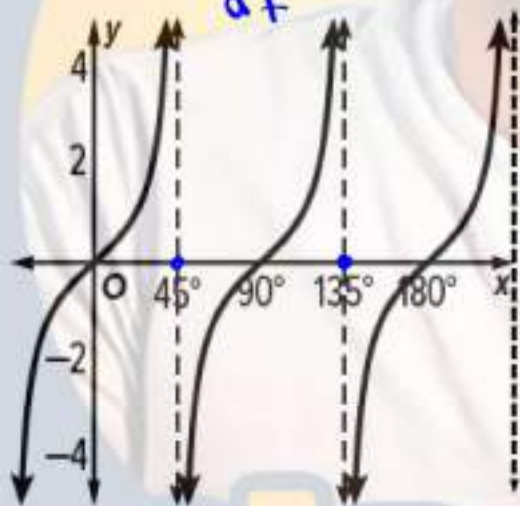
* Transformation

$$y = \tan 2x$$

$b = 2 > 1$ (inside) compressed
Horizontally.

* graph

a +



$$* \text{Asym } x = 45 + 90n$$

$$n = 0, \pm 1, \pm 2$$

$$x = 45, \pm 135, 225$$

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5. $y = 2 \tan \frac{1}{2}x$

$a=2$, $b=\frac{1}{2}$, $c=0$, $d=0$

* Period = $\frac{\pi}{|b|} = \frac{\pi}{\frac{1}{2}} = 2\pi$

* Asym $x = \frac{90 + 180n}{b} = \frac{90 + 180n}{\frac{1}{2}}$
 $\frac{90}{\frac{1}{2}} + \frac{180n}{\frac{1}{2}} = \frac{180 + 360n}{1}$

* x-intercept = $n \cdot \text{Period} = 2n\pi$

$n = 0, \pm 1, \pm 2, \pm 3$

$x = 0, \pm 2\pi, \pm 4\pi, \pm 6\pi$

* midline $y=d$ $y=0$

* Transformation $y = 2 \tan \frac{1}{2}x$

$a=2 > 1$ stretch vertically

$b=\frac{1}{2} < 1$ stretch horizontally.

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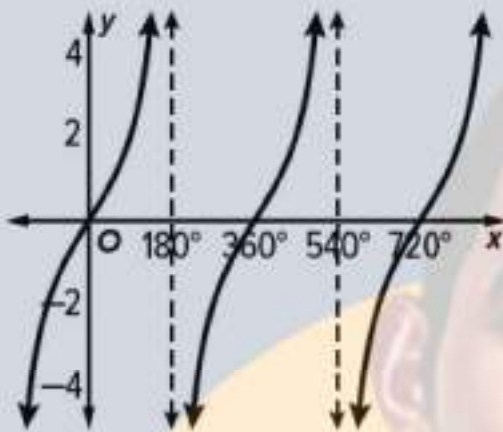
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$$6. y = -\frac{1}{2} \tan 2x$$

$$a = -\frac{1}{2}, \quad b = 2, \quad c = 0, \quad d = 0$$

$$* \text{Period} = \frac{\pi}{|b|} = \frac{\pi}{2} \text{ or } 90^\circ$$

$$* \text{Asym} = \frac{90 + 180n}{b} = \frac{90 + 180n}{2}$$

$$\frac{90}{2} + \frac{180n}{2} = |45 + 90n|$$

$$* \text{x-intercept} = n \cdot \text{Period} = 90n$$

$$n = 0, \pm 1, \pm 2, \pm 3, \dots$$

$$x = 0, \pm 90, \pm 180, \pm 270$$

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* midline

$$y = d$$

$$y = 0$$

* Transformation

$$y = -\frac{1}{2} \tan 2x$$

(-) → Reflection across x -axis
 $a = \frac{1}{2} < 1$ compressed vertically

 $b = 2 > 1$ Compressed Horizontally

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