



Appendix H

For more information, see
the Table of Specifications.

Grade 12 Prototype Examination

Mathematics C

Course Code 8406

Barcode Number	
_____	_____
Month	Day
Date of Birth	

October 2008

Mathematics C

Time: Two and One-Half Hours

Calculators may be used. Only silent hand-held calculators designed for mathematical computations such as logarithmic, trigonometric, and graphing functions are permissible. Computers, calculators with QWERTY keyboards, calculators capable of symbolic manipulation, and electronic writing pads are not allowed. Calculators that have built-in notes (definitions or explanations in alpha notation) that cannot be cleared are not permitted. All calculators must be cleared of programs.

You are allowed to use a print dictionary. No electronic dictionaries, translation dictionaries, or any other notes or reference materials are allowed.

Do not spend too much time on any question. Read the questions carefully.

All items are multiple-choice questions which will be machine scored. Record your answers on the Student Examination Form which is provided. Each question has four suggested answers, one of which is better than the others. Select the **best** answer and record it on the Student Examination Form as shown in the example below:

Example:

1. An angle of $\frac{2\pi}{3}$ radians is equivalent to

Answers:

A. 90°

B. 120°

C. 180°

D. 240°

Student Examination Form:

1. (A) ● (C) (D)

Use an ordinary HB pencil to mark your answers on the Student Examination Form. If you change your mind about an answer, be sure to erase the first mark completely. There should be only one answer marked for each question. Be sure there are no stray pencil marks on your answer sheet. If you need space for rough work, use the space in the examination booklet beside each question.

Do not fold either the Student Examination Form or the examination booklet. Be sure to complete the blue identification section of the Student Examination Form.

Upon completion of the examination, place your Student Examination Form **behind** the examination booklet and **insert both in the same envelope. Be sure to seal the envelope and complete the information requested on the face of the envelope.**

Mathematics C

1. Midpoint: $M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
2. Distance: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
3. Arc length: $s = r\theta$
4. Angular velocity: $w = \frac{\theta}{t}$ OR $w = rps \times 2\pi$ OR $w = rpm \times 2\pi$
5. Linear velocity: $v = rw$
6. Slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$
7. Quadratic Formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Summary of Basic Identities (These identities hold for all values of the variable for which the function values are defined.)

8. Reciprocal Identities

$$\cos \theta \sec \theta = 1 \qquad \sin \theta \csc \theta = 1 \qquad \tan \theta \cot \theta = 1$$

9. The Quotient Identities

$$\tan \theta = \frac{\sin \theta}{\cos \theta} \qquad \cot \theta = \frac{\cos \theta}{\sin \theta}$$

10. The Pythagorean Identities

$$\sin^2 \theta + \cos^2 \theta = 1 \qquad 1 + \tan^2 \theta = \sec^2 \theta \qquad 1 + \cot^2 \theta = \csc^2 \theta$$

11. The Addition Identities

$$\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cos \beta + \sin \alpha \sin \beta$$

$$\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta$$

$$\tan(\alpha + \beta) = \frac{\tan \alpha + \tan \beta}{1 - \tan \alpha \tan \beta} \qquad \tan(\alpha - \beta) = \frac{\tan \alpha - \tan \beta}{1 + \tan \alpha \tan \beta}$$

12. The Double Angle Identities

$$\cos 2\theta = \cos^2 \theta - \sin^2 \theta \quad \sin 2\theta = 2 \sin \theta \cos \theta \quad \tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$$

$$\cos 2\theta = 2 \cos^2 \theta - 1$$

$$\cos 2\theta = 1 - 2 \sin^2 \theta$$

13. The Half Angle Identities

$$\cos \frac{1}{2}\theta = \pm \sqrt{\frac{1 + \cos \theta}{2}} \quad \sin \frac{1}{2}\theta = \pm \sqrt{\frac{1 - \cos \theta}{2}} \quad \tan \frac{1}{2}\theta = \frac{1 - \cos \theta}{\sin \theta}$$

$$\tan \frac{1}{2}\theta = \frac{\sin \theta}{1 + \cos \theta}$$

$$\tan \frac{1}{2}\theta = \pm \sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}}$$

14. Sine Law:

$$\frac{a}{\sin A} = \frac{b}{\sin B} \quad \text{OR} \quad \frac{\sin A}{a} = \frac{\sin B}{b}$$

15. Cosine Law:

$$c^2 = a^2 + b^2 - 2ab \cos C \quad \text{OR} \quad \cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

16. Area of Triangles

$$K = \frac{1}{2} ab \sin C \quad K = \frac{a^2 \sin B \sin C}{2 \sin A}$$

$$K = \sqrt{s(s-a)(s-b)(s-c)}; \text{ where } s = \frac{a+b+c}{2}$$

17. Conics

Circle: $x^2 + y^2 = r^2 \quad (x-h)^2 + (y-k)^2 = r^2$

Parabola: $y = ax^2 \quad y = a(x-h)^2 + k \quad \text{OR} \quad (x-h)^2 = 4p(y-k)$
 $x = ay^2 \quad x = a(y-k)^2 + h \quad \text{OR} \quad (y-k)^2 = 4p(x-h)$
 $a = \frac{1}{4p} \quad x^2 = 4py \quad y^2 = 4px$

Ellipse: $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \quad \frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$

Hyperbola: $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 \quad \frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$
 $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1 \quad \frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$

Table of Trigonometric Ratios

	$\sin \theta$	$\cos \theta$	$\tan \theta$	$\csc \theta$	$\sec \theta$	$\cot \theta$		$\sin \theta$	$\cos \theta$	$\tan \theta$	$\csc \theta$	$\sec \theta$	$\cot \theta$
0	0.0000	1.0000	0.0000		1.0000		45	0.7071	0.7071	1.0000	1.4142	1.4142	1.0000
1	0.0175	0.9998	0.0175	57.298	1.0002	57.290	46	0.7193	0.6947	1.0355	1.3902	1.4396	0.9657
2	0.0349	0.9994	0.0349	28.653	1.0006	28.636	47	0.7314	0.6820	1.0724	1.3673	1.4663	0.9325
3	0.0523	0.9986	0.0524	19.107	1.0014	19.081	48	0.7431	0.6691	1.1106	1.3456	1.4945	0.9004
4	0.0698	0.9976	0.0699	14.335	1.0024	14.300	49	0.7547	0.6561	1.1504	1.3250	1.5243	0.8693
5	0.0872	0.9962	0.0875	11.473	1.0038	11.4301	50	0.7660	0.6428	1.1918	1.3054	1.5557	0.8391
6	0.1045	0.9945	0.1051	9.5668	1.0055	9.5144	51	0.7771	0.6293	1.2349	1.2868	1.5890	0.8098
7	0.1219	0.9925	0.1228	8.2055	1.0075	8.1444	52	0.7880	0.6157	1.2799	1.2690	1.6243	0.7813
8	0.1392	0.9903	0.1405	7.1853	1.0098	7.1154	53	0.7986	0.6018	1.3270	1.2521	1.6616	0.7536
9	0.1564	0.9877	0.1584	6.3925	1.0125	6.3138	54	0.8090	0.5878	1.3764	1.2361	1.7013	0.7265
10	0.1736	0.9848	0.1763	5.7588	1.0154	5.6713	55	0.8192	0.5736	1.4281	1.2208	1.7434	0.7002
11	0.1908	0.9816	0.1944	5.2408	1.0187	5.1446	56	0.8290	0.5592	1.4826	1.2062	1.7883	0.6745
12	0.2079	0.9781	0.2126	4.8097	1.0223	4.7046	57	0.8387	0.5446	1.5399	1.1924	1.8361	0.6494
13	0.2250	0.9744	0.2309	4.4454	1.0263	4.3315	58	0.8480	0.5299	1.6003	1.1792	1.8871	0.6249
14	0.2419	0.9703	0.2493	4.1336	1.0306	4.0108	59	0.8572	0.5150	1.6643	1.1666	1.9416	0.6009
15	0.2588	0.9659	0.2679	3.8637	1.0353	3.7321	60	0.8660	0.5000	1.7320	1.1547	2.0000	0.5774
16	0.2756	0.9613	0.2867	3.6280	1.0403	3.4874	61	0.8746	0.4848	1.8040	1.1434	2.0627	0.5543
17	0.2924	0.9563	0.3057	3.4203	1.0457	3.2709	62	0.8829	0.4695	1.8807	1.1326	2.1301	0.5317
18	0.3090	0.9511	0.3249	3.2361	1.0515	3.0777	63	0.8910	0.4540	1.9626	1.1223	2.2027	0.5095
19	0.3256	0.9455	0.3443	3.0716	1.0576	2.9042	64	0.8988	0.4384	2.0503	1.1126	2.2812	0.4877
20	0.3420	0.9397	0.3640	2.9238	1.0642	2.7475	65	0.9063	0.4226	2.1445	1.1034	2.3662	0.4663
21	0.3584	0.9336	0.3839	2.7904	1.0711	2.6051	66	0.9135	0.4067	2.2460	1.0946	2.4586	0.4452
22	0.3746	0.9272	0.4040	2.6695	1.0785	2.4751	67	0.9205	0.3907	2.3558	1.0864	2.5593	0.4245
23	0.3907	0.9205	0.4245	2.5593	1.0864	2.3559	68	0.9272	0.3746	2.4751	1.0785	2.6695	0.4040
24	0.4067	0.9135	0.4452	2.4586	1.0946	2.2460	69	0.9336	0.3584	2.6051	1.0711	2.7904	0.3839
25	0.4226	0.9063	0.4663	2.3662	1.1034	2.1445	70	0.9397	0.3420	2.7475	1.0642	2.9238	0.3640
26	0.4384	0.8988	0.4877	2.2812	1.1126	2.0503	71	0.9455	0.3256	2.9042	1.0576	3.0715	0.3443
27	0.4540	0.8910	0.5095	2.2027	1.1223	1.9626	72	0.9511	0.3090	3.0777	1.0515	3.2361	0.3249
28	0.4695	0.8829	0.5317	2.1301	1.1326	1.8807	73	0.9563	0.2924	3.2708	1.0457	3.4203	0.3057
29	0.4848	0.8746	0.5543	2.0627	1.1434	1.8040	74	0.9613	0.2756	3.4874	1.0403	3.6279	0.2867
30	0.5000	0.8660	0.5773	2.0000	1.1547	1.7321	75	0.9659	0.2588	3.7320	1.0353	3.8637	0.2680
31	0.5150	0.8572	0.6009	1.9416	1.1666	1.6643	76	0.9703	0.2419	4.0108	1.0306	4.1335	0.2493
32	0.5299	0.8480	0.6249	1.8871	1.1792	1.6003	77	0.9744	0.2250	4.3315	1.0263	4.4454	0.2309
33	0.5446	0.8387	0.6494	1.8361	1.1924	1.5399	78	0.9781	0.2079	4.7046	1.0223	4.8097	0.2126
34	0.5592	0.8290	0.6745	1.7883	1.2062	1.4826	79	0.9816	0.1908	5.1445	1.0187	5.2408	0.1944
35	0.5736	0.8192	0.7002	1.7434	1.2208	1.4281	80	0.9848	0.1736	5.6712	1.0154	5.7587	0.1763
36	0.5878	0.8090	0.7265	1.7013	1.2361	1.3764	81	0.9877	0.1564	6.3137	1.0125	6.3924	0.1584
37	0.6018	0.7986	0.7536	1.6616	1.2521	1.3270	82	0.9903	0.1392	7.1153	1.0098	7.1852	0.1405
38	0.6157	0.7880	0.7813	1.6243	1.2690	1.2799	83	0.9925	0.1219	8.1443	1.0075	8.2054	0.1228
39	0.6293	0.7771	0.8098	1.5890	1.2868	1.2349	84	0.9945	0.1045	9.5143	1.0055	9.5667	0.1051
40	0.6428	0.7660	0.8391	1.5557	1.3054	1.1918	85	0.9962	0.0872	11.429	1.0038	11.473	0.0875
41	0.6561	0.7547	0.8693	1.5243	1.3250	1.1504	86	0.9976	0.0698	14.300	1.0024	14.335	0.0699
42	0.6691	0.7431	0.9004	1.4945	1.3456	1.1106	87	0.9986	0.0523	19.080	1.0014	19.106	0.0524
43	0.6820	0.7314	0.9325	1.4663	1.3673	1.0724	88	0.9994	0.0349	28.635	1.0006	28.652	0.0349
44	0.6947	0.7193	0.9657	1.4396	1.3902	1.0355	89	0.9998	0.0175	57.285	1.0002	57.294	0.0175
							90	1.0000	0.0000		1.0000		0.0000

GRADE 12 DEPARTMENTAL EXAMINATION

MATHEMATICS C 30, PROTOTYPE EXAM

VALUE 100 (50 × 2)

Answer the following 50 questions on the computer sheet entitled “Student Examination Form.”

1. A ball and a bat together cost \$27.00. If the bat costs \$20 **more** than the ball, then the ball costs
 - A. \$1.75
 - B. \$3.50
 - C. \$7.00
 - D. \$10.50

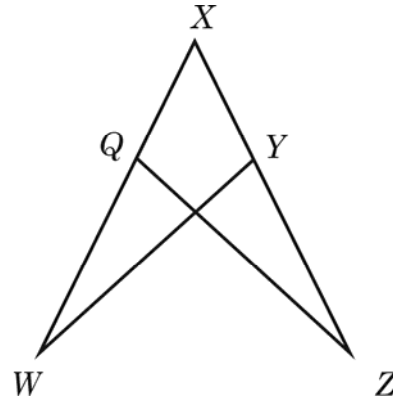
2. On four previous occasions John noticed that his dog, Bernie, barked when the garage door opened. He concluded that Bernie would bark the next time the garage door opened. To arrive at his conclusion he used
 - A. indirect reasoning.
 - B. deductive reasoning.
 - C. inductive reasoning.
 - D. proof by contradiction.

3. Consider the following proof.

Given: $\overline{XY} \cong \overline{XQ}$

$\overline{QW} \cong \overline{YZ}$

Prove: $\triangle XYW \cong \triangle XQZ$

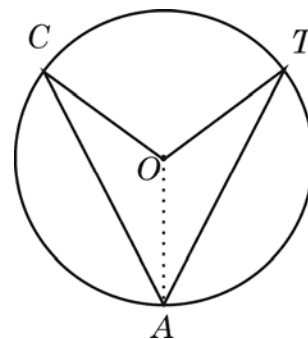


Statement	Reason
Step 1: $\overline{XY} \cong \overline{XQ}$ $\overline{QW} \cong \overline{YZ}$	given
Step 2: $\angle WXY \cong \angle ZXQ$	same angle (reflexive property of equality)
Step 3: <u>I</u>	<u>II</u>
Step 4: $\triangle XYW \cong \triangle XQZ$	<u>III</u>

The missing information in the above proof is

- A. I: $\overline{XQ} \cong \overline{QW}$; II: definition of midpoint; III: SAS
- B. I: $\overline{XW} \cong \overline{XZ}$; II: addition of congruent parts; III: SAS
- C. I: $\overline{WY} \cong \overline{ZQ}$; II: isosceles triangle theorem; III: SSS
- D. I: $\overline{WY} \cong \overline{ZQ}$; II: given; III: SSS

4. For the diagram shown, it is given that O is the centre of the circle and $\overline{AC} \cong \overline{AT}$. $\angle AOC$ can be proven congruent to $\angle AOT$ by

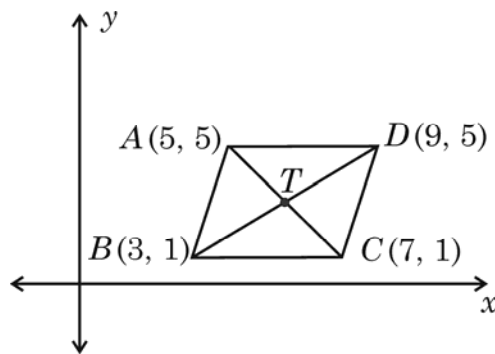


- A. AAS
- B. ASA
- C. HL(HS)
- D. SSS

5. Consider the following proof.

Given: $ABCD$ is a parallelogram

Prove: $AB = CD$



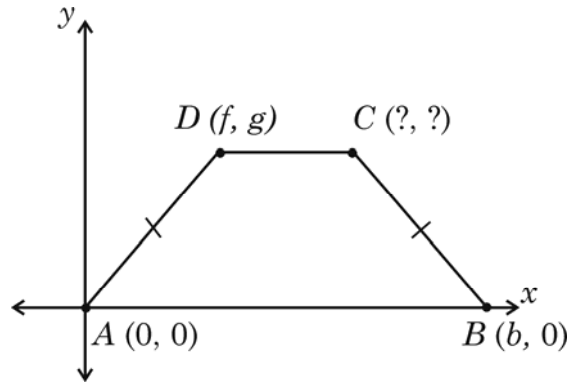
Statement	Reason
Step 1: $ABCD$ is a parallelogram	given
Step 2: $AB = \underline{\text{I}}$	distance formula
Step 3: $CD = \underline{\text{II}}$	distance formula
Step 4: $AB = CD$	<u>III</u>

The missing information in the above proof is

- A. I: $\sqrt{(5-7)^2 + (5-1)^2} = 2\sqrt{5}$
 II: $\sqrt{(9-3)^2 + (5-1)^2} = 2\sqrt{5}$
 III: reflexive property
- B. I: $\sqrt{(5-3)^2 + (5-1)^2} = 2\sqrt{5}$
 II: $\sqrt{(9-7)^2 + (5-1)^2} = 2\sqrt{5}$
 III: transitive property of equality
- C. I: $\sqrt{(3-5)^2 + (5-1)^2} = 2\sqrt{3}$
 II: $\sqrt{(7-9)^2 + (5-1)^2} = 2\sqrt{3}$
 III: transitive property of equality
- D. I: $\frac{5-1}{5-3} = \frac{4}{2} = 2$
 II: $\frac{5-1}{9-7} = \frac{4}{2} = 2$
 III: reflexive property

6. In the isosceles trapezoid shown, the coordinates of the point C are

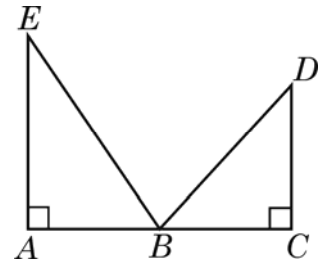
- A. $(b + f, g)$
- B. (b, g)
- C. $(b + g, f)$
- D. $(b - f, g)$



7. If $3f$ is an integer, then an integer divisible by 4 would have the form

- A. $4f$
- B. $3f + 1$
- C. $4(3f)$
- D. $4(3f) + 1$

8. The point B is a midpoint of \overline{AC} with $\overline{EA} \perp \overline{AB}$, $\overline{DC} \perp \overline{BC}$, and $\overline{EA} \neq \overline{DC}$.



In order to prove indirectly that $\overline{EB} \neq \overline{DB}$ it must first be assumed that

- A. $\overline{EB} = \overline{DB}$
- B. $\overline{AB} \neq \overline{BC}$
- C. $\overline{AB} = \overline{BC}$
- D. $\angle A$ is a right angle

9. If the statement $2 + 5 + 8 + 11 + \dots + (3n - 1) = \frac{n(1 - 3n)}{2}$ is true when $n = k + 1$, then the right hand side of the statement would be
- A. $\frac{(k + 1)(2 - 3k)}{2}$
- B. $\frac{(k + 1)(-2 - 2k)}{2}$
- C. $\frac{(k + 1)(-2 - 3k)}{2}$
- D. $\frac{(k + 1)(4 - 3k)}{2}$
10. In proving that $1 + 2 + 3 + \dots + n = \frac{n(n + 1)}{2}$ by mathematical induction, the first step is to
- A. assume it is true for $n = 1$.
- B. assume it is true for $n = k$.
- C. prove it is true for $n = 1$.
- D. prove it is true for $n = k$.
11. A proof by mathematical induction of $6 + 8 + 10 + \dots + (2n + 4) = n^2 + 5n$ is started below.

Step 1:	when $n = 1$	when $n = 2$	when $n = 3$
	$6 = (1)^2 + 5(1)$	$6 + 8 = 2^2 + 5(2)$	$6 + 8 + 10 = 3^2 + 5(3)$
	\checkmark $6 = 6$	\checkmark $14 = 14$	\checkmark $24 = 24$

Step 2: assume when $n = k$ that $6 + 8 + 10 + \dots + (2k + 4) = k^2 + 5k$

Step 3: when $n = k + 1$ then

$$6 + 8 + 10 + \dots + (2k + 4) + (2(k + 1) + 4) = (k + 1)^2 + 5(k + 1)$$

The next step in the proof is showing that

- A. $(2k + 4) + (2k + 1) = (k + 1)^2 + 5(k + 1)$
- B. $(2k + 4) + (2k + 6) = (k + 1)^2 + 5(k + 1)$
- C. $(k^2 + 5k) + (2k + 6) = (k + 1)^2 + 5(k + 1)$
- D. $(k^2 + 5k) + (2k + 1) = (k + 1)^2 + 5(k + 1)$

12. An example of an equation for a hyperbola is

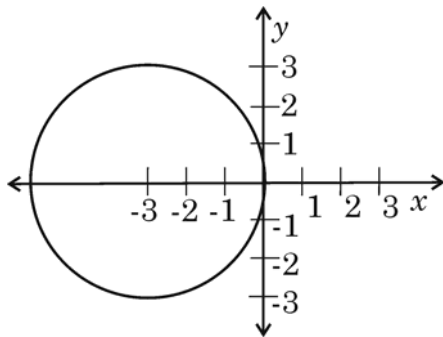
- A. $x^2 + 3y^2 - 4x + 2y - 7 = 0$
- B. $3x^2 + 3y^2 - 16 = 0$
- C. $-x^2 + 7x + 4y = 0$
- D. $-2x^2 + 3y^2 - y + 1 = 0$

13. The graph of $(x - 2)^2 + (y + 4)^2 = 25$ is a circle. The centre and radius of this circle are

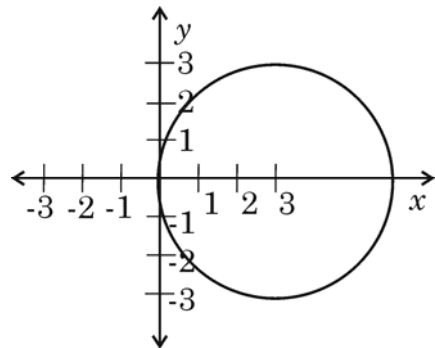
- A. $C(2, -4)$, radius $\sqrt{5}$
- B. $C(-2, 4)$, radius $\sqrt{5}$
- C. $C(2, -4)$, radius 5
- D. $C(-2, 4)$, radius 5

14. The sketch that represents the graph of $2(x + 3)^2 + 2y^2 = 18$ is

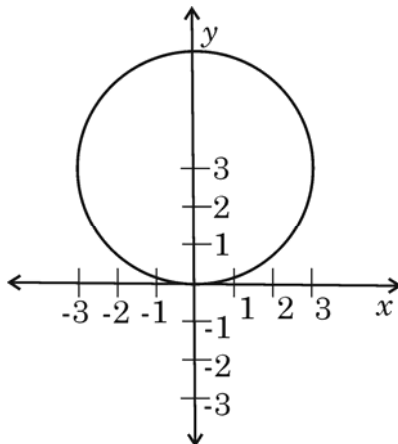
A.



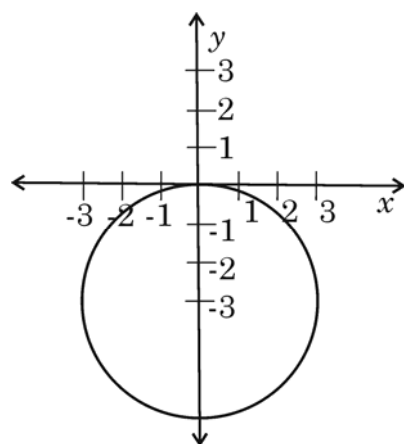
B.



C.

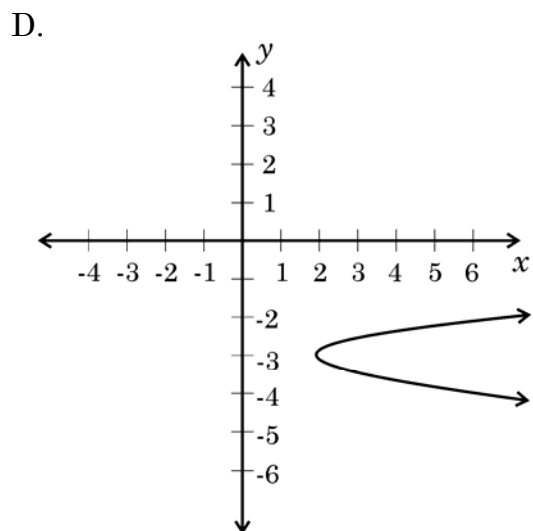
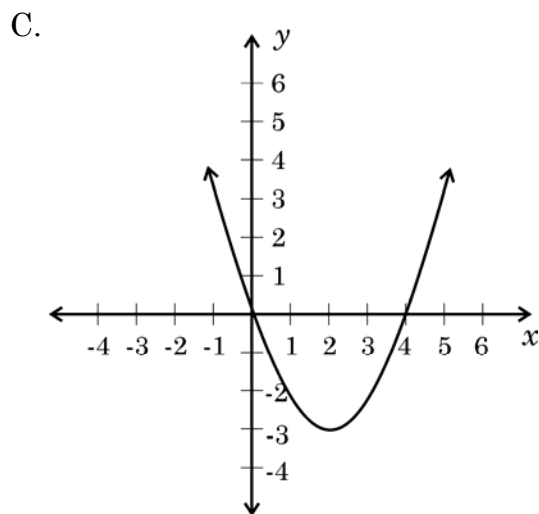
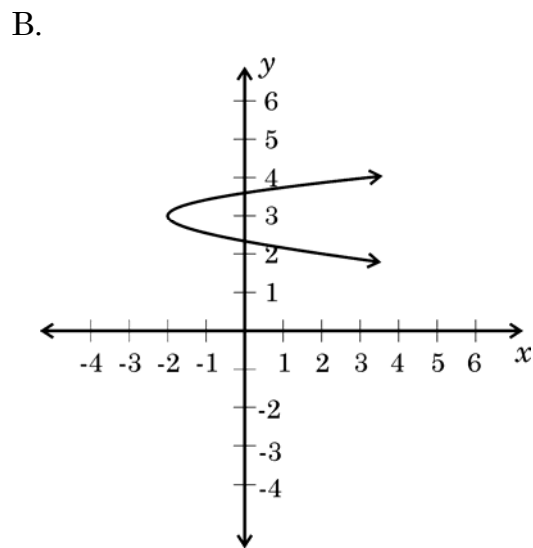
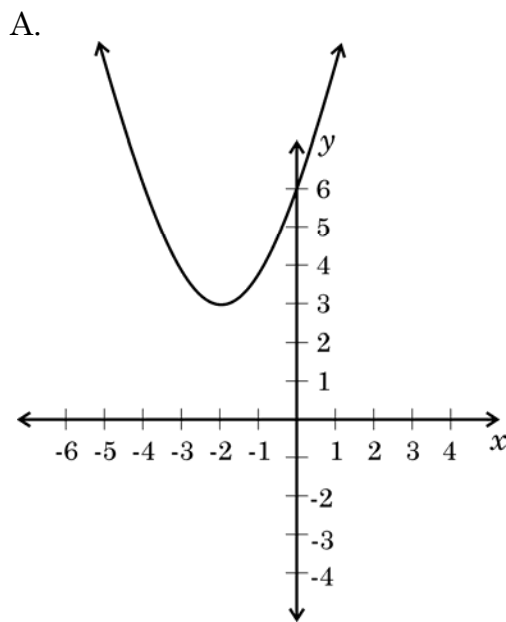


D.

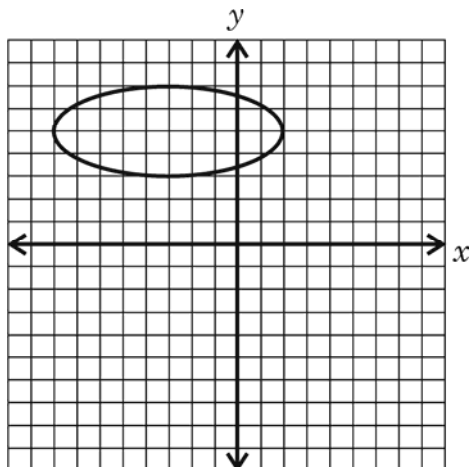


15. The equation, in standard form, of the parabola defined by $2x^2 - 4x - y + 5 = 0$ is
- A. $y = -2(x - 1)^2 - 6$
 - B. $y = -2(x - 1)^2 - 3$
 - C. $y = 2(x - 1)^2 + 3$
 - D. $y = 2(x - 1)^2 + 4$

16. The graph best represented by the equation $(x - 2) = 5(y + 3)^2$ is



17. The graph shown is defined by the equation

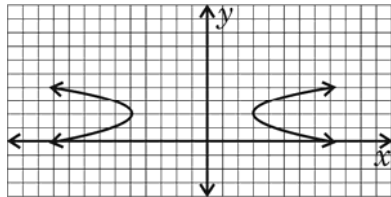


- A. $4x^2 + 25y^2 + 24x - 250y + 561 = 0$
B. $4x^2 + 25y^2 - 24x + 250y + 561 = 0$
C. $25x^2 + 4y^2 + 150x - 40y + 324 = 0$
D. $25x^2 + 4y^2 - 150x + 40y + 324 = 0$
18. The general form of the equation of a hyperbola is $5x^2 - 3y^2 + 10x - 24y - 58 = 0$. The equation of the same hyperbola in standard form is

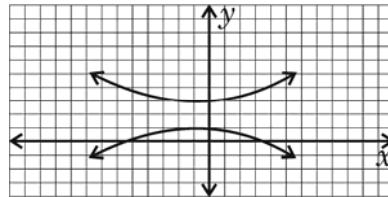
- A. $\frac{(y+1)^2}{3} - \frac{(x+4)^2}{5} = 1$
B. $\frac{(x+4)^2}{3} - \frac{(y+1)^2}{5} = 1$
C. $\frac{(y+4)^2}{3} - \frac{(x+1)^2}{5} = 1$
D. $\frac{(x+1)^2}{3} - \frac{(y+4)^2}{5} = 1$

19. The hyperbola represented by $\frac{(x+1)^2}{16} - \frac{(y-2)^2}{1} = 1$ is

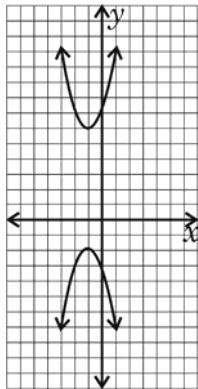
A.



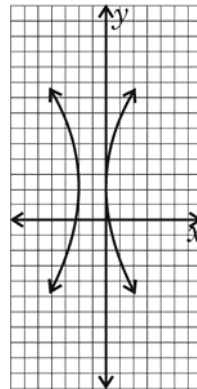
B.



C.



D.



20. The system of equations $\begin{cases} y = x^2 + 3 \\ x^2 + y^2 = 9 \end{cases}$ has the solution set

- A. (3, 0)
- B. (0, 3)
- C. (± 3 , 0)
- D. (0, ± 3)

21. The terminal arm of an angle of -330° would pass through the point

A. $\left(\frac{-\sqrt{3}}{2}, \frac{1}{2}\right)$

B. $\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$

C. $\left(\frac{\sqrt{3}}{2}, \frac{-1}{2}\right)$

D. $\left(\frac{-\sqrt{3}}{2}, \frac{-1}{2}\right)$

22. The value of $\csc 240^\circ$ is

A. $\frac{-2\sqrt{3}}{3}$

B. $\frac{\sqrt{3}}{2}$

C. $\frac{-\sqrt{2}}{2}$

D. $\frac{-1}{2}$

23. An angle of 260° converted to radians is

A. $\frac{15\pi}{9}$ radians.

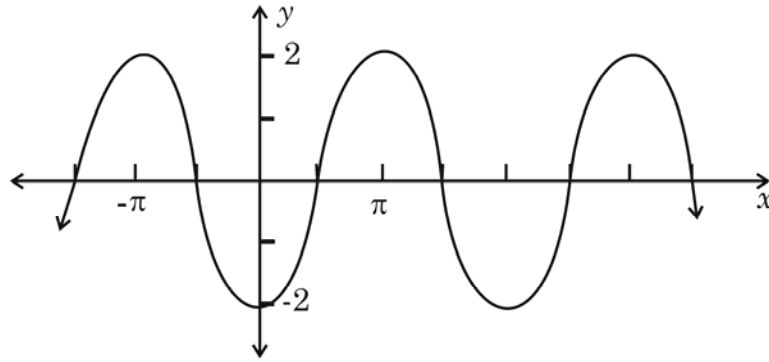
B. $\frac{13\pi}{9}$ radians.

C. $\frac{11\pi}{9}$ radians.

D. $\frac{2\pi}{3}$ radians.

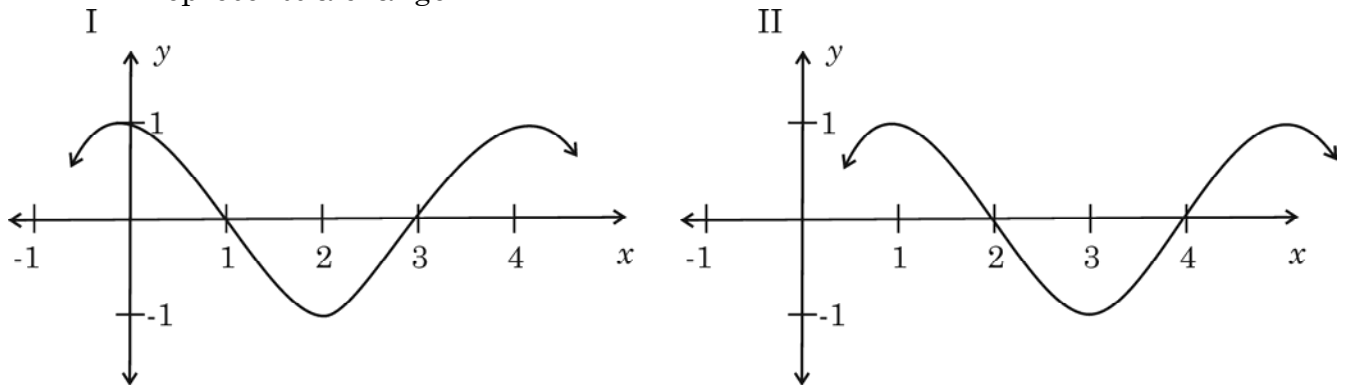
24. The angular velocity of a car tire turning 240 revolutions per minute is
- A. 2π rad/s
 - B. 4π rad/s
 - C. 6π rad/s
 - D. 8π rad/s
25. A train is travelling at 75 km/h. The wheels on the train have a radius of 48 cm. What is the angular velocity (to the nearest tenth) of the wheel?
- A. 2.7 rad/s
 - B. 43.4 rad/s
 - C. 69.1 rad/s
 - D. 248.7 rad/s
26. A new spool of cable is rotated through $\frac{5}{8}$ of a turn. As the spool is rotated, 2.3 m of cable is unravelled. Find the radius of the spool, to the nearest cm.
- A. 59 cm
 - B. 144 cm
 - C. 256 cm
 - D. 368 cm

27. The amplitude of the function represented by the graph is



- A. 2
- B. -2
- C. 2π
- D. -2π

28. In the graphs shown, the change in function from graph I to graph II represents a change in

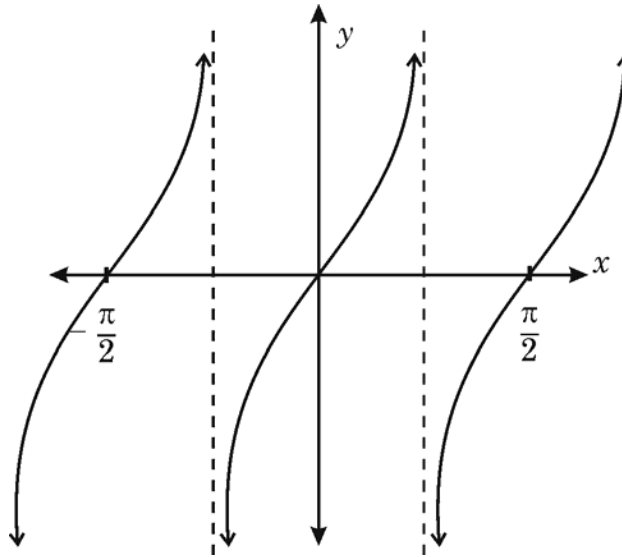


- A. amplitude.
- B. period.
- C. phase shift.
- D. vertical translation.

29. For the graph of $y = -2 \cos\left(4\theta + \frac{\pi}{2}\right) + 1$, $\frac{\pi}{2}$ represents the

- A. amplitude.
- B. period.
- C. phase shift.
- D. vertical shift.

30. The equation that best represents the graph shown is



- A. $y = 2 \tan x$
- B. $y = -2 \tan\left(x + \frac{\pi}{4}\right)$
- C. $y = -\tan 2\left(x + \frac{\pi}{4}\right)$
- D. $y = \tan 2x$

31. A painter's ladder is 15 metres long. It touches the top of a vertical wall when it is placed at an angle of 65° with the level ground. The height of the wall is

- A. 7.5 m
- B. 13.6 m
- C. 17.8 m
- D. 24.3 m

32. In $\triangle KEJ$, $\angle K = 113^\circ$, $\angle E = 16^\circ$, and $k = 9.6$ cm. The length of j is
- A. 8.1 cm
 - B. 11.4 cm
 - C. 27.1 cm
 - D. 52.7 cm
33. In $\triangle ABC$, $a = 7.6$ cm, $b = 7.0$ cm, and $c = 8.2$ cm. To the nearest degree, the measure of the largest angle is
- A. 22°
 - B. 52°
 - C. 59°
 - D. 68°
34. In $\triangle ABC$, $\angle A = 30^\circ$, and side $c = 18$ cm. In order for there to be **two** possible solutions to $\triangle ABC$, side a must be
- A. $9 \text{ cm} < a$
 - B. $9 \text{ cm} < a < 18 \text{ cm}$
 - C. $18 \text{ cm} < a$
 - D. $18 \text{ cm} < a < 27 \text{ cm}$
35. For security reasons, a triangular area has been roped off, and three security guards, Hamish, Narish, and Gwen, each stand at one corner of the roped off area. The angle formed by the rope at Gwen's corner is 75° , while the angle formed at Narish's corner is 64° . If the length of rope between Gwen and Narish is 15 m, then the length of the rope between Gwen and Hamish is
- A. 10.0 m
 - B. 10.9 m
 - C. 20.5 m
 - D. 22.1 m

36. A triangle has two sides measuring 13 units and 11 units, and the angle included by these two sides is 44° . The area of the triangle, to the nearest unit, is
- A. 48 square units.
 - B. 50 square units.
 - C. 51 square units.
 - D. 53 square units.
37. A large triangular flag measures $2\text{ m} \times 4\text{ m} \times 5\text{ m}$. The area of this flag is approximately
- A. 2 m^2
 - B. 4 m^2
 - C. 6 m^2
 - D. 8 m^2
38. Which of the following is an identity?
- A. $\sec^2 \theta - 1 = \tan^2 \theta$
 - B. $\csc^2 \theta + \sec^2 \theta = 1$
 - C. $2\sin^2 \theta - 1 = \cos^2 \theta$
 - D. $\cos^2 \theta - \sin^2 \theta = 1$
39. A simplified form of $\frac{\sin^2 \theta}{\cos^2 \theta}$ is
- A. $\tan^2 \theta$
 - B. $\cot^2 \theta$
 - C. $\tan \theta$
 - D. $\cot \theta$

40. A simplified form of $\frac{1}{1 - \cos \theta} + \frac{1}{1 + \cos \theta}$ is
- A. $\sec^2 \theta$
 - B. $\csc^2 \theta$
 - C. $2\sec^2 \theta$
 - D. $2\csc^2 \theta$
41. The value of $\cos 37^\circ \cos 23^\circ - \sin 37^\circ \sin 23^\circ$ is
- A. $\frac{1}{2}$
 - B. $\frac{\sqrt{2}}{2}$
 - C. $\frac{\sqrt{3}}{2}$
 - D. 1
42. A simplified form of $1 - 2\sin^2 72^\circ$ is
- A. $\sin 36^\circ$
 - B. $\cos 36^\circ$
 - C. $\sin 144^\circ$
 - D. $\cos 144^\circ$
43. If $\cos 3\theta = 4\cos^3 \theta - 3\cos \theta$, and $\cos \theta = \frac{-1}{3}$, then $\cos 3\theta$ is equal to
- A. -1
 - B. $\frac{-23}{27}$
 - C. $\frac{23}{27}$
 - D. 1

44. The expression $\sqrt{\frac{1 - \cos 60^\circ}{2}}$ is equivalent to
- A. $\frac{1}{2}$
 - B. $\frac{\sqrt{2}}{2}$
 - C. $\frac{\sqrt{3}}{2}$
 - D. 1
45. The simplified form of $\sin \theta (\cot \theta + 1)$ is
- A. $\cos \theta + \sin \theta$
 - B. $\sin^2 \theta - 1$
 - C. $\sec \theta$
 - D. $\cot \theta - 1$
46. The expression $\frac{1}{\sec \beta} + \sin \beta \tan \beta$ is equivalent to
- A. $\tan \beta$
 - B. $\cot \beta$
 - C. $\csc \beta$
 - D. $\sec \beta$
47. A simplified form of $\tan A \cot A + \cot^2 A$ is
- A. $\cos^2 A$
 - B. $\sin^2 A$
 - C. $\sec^2 A$
 - D. $\csc^2 A$

48. The general solution of $2\sin^2 \theta = 1$, where n is an integer, is

- A. $\{30^\circ + n \cdot 90^\circ\}$
- B. $\{30^\circ + n \cdot 180^\circ\}$
- C. $\{45^\circ + n \cdot 90^\circ\}$
- D. $\{45^\circ + n \cdot 180^\circ\}$

49. The solutions for $2\sin 2\theta = \sqrt{3}$, where $0 \leq \theta < 2\pi$, are

- A. $\frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$
- B. $\frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$
- C. $\frac{\pi}{6}, \frac{\pi}{3}, \frac{7\pi}{6}, \frac{4\pi}{3}$
- D. $\frac{\pi}{6}, \frac{2\pi}{3}, \frac{5\pi}{6}, \frac{7\pi}{6}$

50. The equation $3\cos \alpha - 2 = 0$ for $0^\circ \leq \alpha < 360^\circ$ has

- A. 0 solutions.
- B. 1 solution.
- C. 2 solutions.
- D. 4 solutions.

**GRADE 12 DEPARTMENTAL EXAMINATION
MATHEMATICS C, PROTOTYPE EXAM — Answer Key**

(See Explanation of Answers)

1. B	11. C	21. B	31. B	41. A
2. C	12. D	22. A	32. A	42. D
3. B	13. C	23. B	33. D	43. C
4. D	14. A	24. D	34. B	44. A
5. B	15. C	25. B	35. C	45. A
6. D	16. D	26. A	36. B	46. D
7. C	17. A	27. A	37. B	47. D
8. A	18. D	28. C	38. A	48. C
9. C	19. A	29. B	39. A	49. C
10. C	20. B	30. D	40. D	50. C

Explanation of Answers

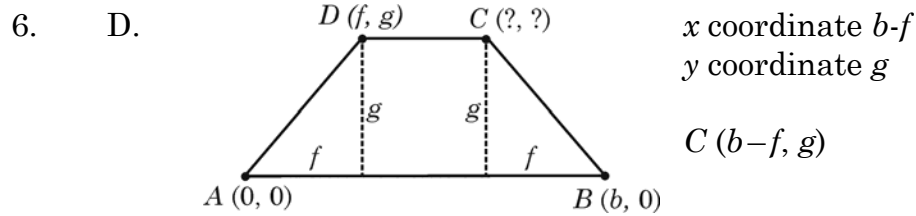
1. B. $ball + bat = 27.00$ $ball + 20 = bat$
 $ball + (ball + 20) = 27$
 $2b + 20 = 27$
 $2b = 27$
 $b = 3.5$ Ball costs \$3.50

2. C. predicting an outcome based on a recognized pattern
 \therefore inductive reasoning

3. B. $\overline{XQ} \cong \overline{XY}$ given
 $\overline{QW} \cong \overline{YZ}$
 $\angle WXY \cong \angle ZXQ$ same angle (reflexive property)
 $*\overline{XW} \cong \overline{XZ}$ *addition of congruent parts
 $\triangle XYW \cong \triangle XQZ$ *SAS

4. D. all three sides are congruent \therefore SSS

5. B. length $AB = \sqrt{(5-3)^2 + (5-1)^2} \rightarrow \sqrt{4+16} \rightarrow \sqrt{20} \rightarrow 2\sqrt{5}$
 $CD = \sqrt{(9-7)^2 + (5-1)^2} \rightarrow \sqrt{4+16} \rightarrow \sqrt{20} \rightarrow 2\sqrt{5}$
transitive property $CD = AB$



7. C. An integer divisible by 4 has the form $4(x)$, if $3f$ is an integer then $4(3f)$ is divisible by 4

8. A. indirect proof \rightarrow assume the opposite of what is trying to be proved
 $\overline{EB} \neq \overline{DB}$, therefore assume $\overline{ED} \cong \overline{DB}$

9. C. $\frac{n(1-3n)}{2}$ becomes $\downarrow \frac{(k+1)(1-3(k+1))}{2}$
 $\downarrow \frac{(k+1)(1-3k-3)}{2}$
 $\frac{(k+1)(-3k-2)}{2}$ or $\frac{(k+1)(-2-3k)}{2}$

10. C. The first step in an inductive proof is to prove that it is true for $n = 1$

11. C. Step 1: prove true for $n = 1, n = 2, n = 3$
 Step 2: assume true for $n = k$
 Step 3: when $n = k + 1$ then

$$\underbrace{6 + 8 + 10 + \dots + (2k + 4)}_{k^2 + 5k} + \underbrace{(2(k + 1) + 4)}_{(k + 1)} = (k + 1)^2 + 5(k + 1)$$

$$k^2 + 5k + (k + 1) = (k + 1)^2 + 5(k + 1)$$

12. D. Hyperbola $A \neq B$ and they must have opposite signs

13. C. $(x - 2)^2 + (y + 4)^2 = 25$ centre $(2, -4)$, radius 5

14. A. $2(x + 3)^2 + 2(y)^2 = 18$
 $(x + 3) + y^2 = 9$ centre $(-3, 0)$, radius 3

15. C. $y = 2x^2 - 4x + 5$
 $y = 2(x^2 - 2x + 1) + 5 - 2$
 $y = 2(x - 1)^2 + 3$

16. D. vertex $(2, -3)$
 $+y^2 \rightarrow$ opening

17. A. Graph centre $(-3, 5)$, horizontal major axis (10), minor axis (4)

$$\frac{(x+3)^2}{25} + \frac{(y-5)^2}{4} = 1$$

$$\frac{x^2 + 6x + 9}{25} + \frac{y^2 - 10y + 25}{4} = 1$$

$$4x^2 + 24x + 36 + 25y^2 - 250y + 625 = 100$$

$$4x^2 + 25y^2 + 24x - 250y + 561 = 0$$

18. D.

$$5x^2 - 3y^2 + 10x - 24y - 58 = 0$$

$$5x^2 + 10x - 3y^2 - 24y = 58$$

$$5(x^2 + 2x + 1) - 3(y^2 + 8y + 16) = 58 + 5 - 48$$

$$5(x+1)^2 - 3(y+4)^2 = 15$$

$$\frac{(x+1)^2}{3} - \frac{(y+4)^2}{5} = 1$$

19. A. $\frac{(x+1)^2}{16} - \frac{(y-2)^2}{1} = 1$ centre $(-1, 2)$, major axis $\leftrightarrow (8)$

20. B.

$$y = x^2 + 3 \quad x^2 = y - 3 \quad y = -4 \quad y = 3$$

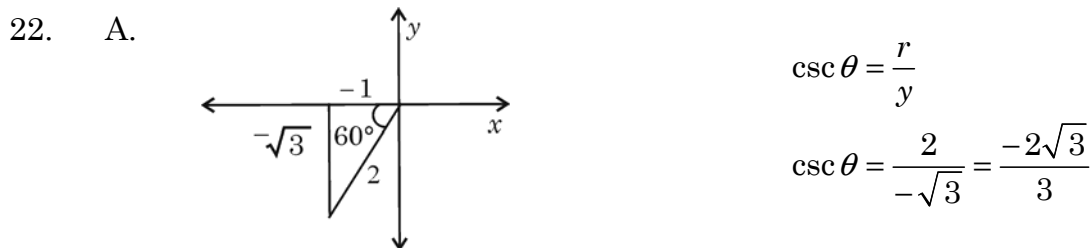
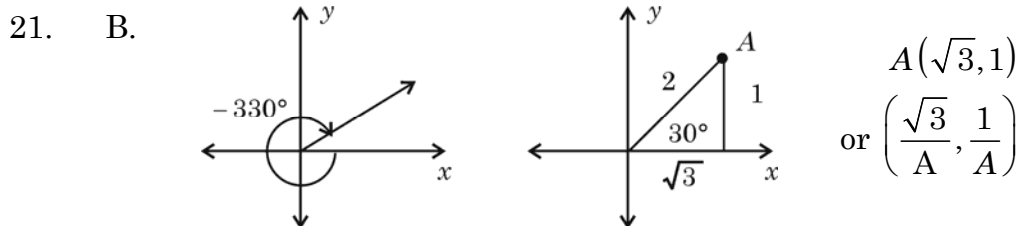
$$x^2 + y^2 = 9 \quad -4 = x^2 + 3 \quad 3 = x^2 + 3$$

$$(y-3) + y^2 = 9 \quad x^2 = -1 \quad x^2 = 0$$

$$y^2 + y - 12 = 0 \quad \text{no solution} \quad x = 0$$

$$(y+4)(y-3) = 0 \quad (0, 3)$$

$$y = -4, y = 3$$



23. B. $260\left(\frac{\pi}{180}\right) = \frac{260\pi}{180} = \frac{13\pi}{9}$

24. D. $240 \div 60 = 4 \text{ rev/sec}$
 $4 \text{ rev/sec} \times 2\pi \rightarrow 8\pi \text{ rad/sec}$

25. B. $v = wr$
 $w = \frac{v}{r}$
 $r = 0.48 \text{ m}$
 $v = 75 \text{ km/h} = \frac{750 \text{ m}}{36 \text{ s}}$
 $\frac{750 \text{ m}}{36 \text{ s}} \div 0.48 = 43.4 \text{ rad/sec}$

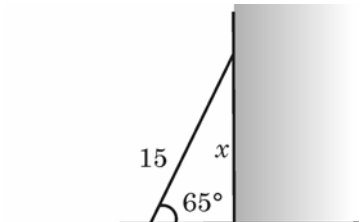
26. A. $s = \theta \times r$ $\theta = \frac{5}{8} \times 2\pi = \frac{10\pi}{8} = \frac{5\pi}{4}$
 $230 \text{ cm} = \frac{5\pi}{4} \times r$ $s = 2.3 \text{ m} = 230 \text{ cm}$
 $r = \frac{4.230 \text{ cm}}{5\pi}$
 $= 58.57 \text{ cm}$

27. A. $\text{amp} = \frac{2 - (-2)}{2} = 2$

28. C. The graph is shifted one unit right \therefore phase shift.

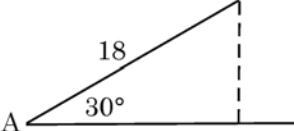
29. B. $y = -2 \cos\left(4\theta + \frac{\pi}{2}\right) + 1$
 $y = -2 \cos 4\left(\theta + \frac{\pi}{8}\right) + 1$
- amplitude = 2 (reflected)
- period = $\frac{2\pi}{4} = \frac{\pi}{2}$
- phase shift = left $\frac{\pi}{8}$
- vertical shift = up 1

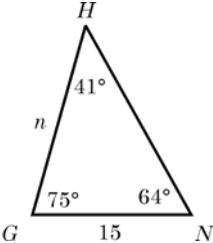
30. D. graph is a tangent function with no phase shift but a period of $\frac{\pi}{2}$ instead of π , $\therefore y = \tan 2x$

31. B.  $\sin 65^\circ = \frac{x}{15}$
 $15 \times \sin 65^\circ = x = 13.59 \text{ m}$

32. A.  $\angle J = 180 - (113 + 16)$
 $\frac{j}{\sin 51^\circ} = \frac{9.6}{\sin 113^\circ}$
 $j = \frac{9.6 \sin 51^\circ}{\sin 113^\circ} = 8.1 \text{ cm}$

33. D. $8.2^2 = 7.6^2 + 7.0^2 - 2(7.6)(7.0) \cos 2C$
 $67.24 = 106.76 - 106.4 \cos \angle C$
 $-39.52 = -106.4 \cos \angle C$
 $\cos \angle C = \frac{39.52}{106.4}$
 $\angle C = \text{inv cos} \left(\frac{39.52}{106.4} \right) = 68.2$

34. B.  $h = 18 \sin 30 = 9 \text{ cm}$
 \therefore two solutions
 $9 \text{ cm} < a < 18 \text{ cm}$

35. C.  $\angle h = 180 - (75^\circ + 64^\circ)$
 $= 41^\circ$
 $\frac{n}{\sin 64^\circ} = \frac{15}{\sin 41^\circ}$
 $n = \frac{15 \sin 64^\circ}{\sin 41^\circ} = 20.54 \text{ m}$

36. B. $A = \frac{1}{2}ab \sin \angle C$
 $A = \frac{1}{2}(13)(11) \sin 44^\circ$
 $= 49.67$ square units
37. B. $A = \sqrt{s(s-a)(s-b)(s-c)}$ $s = \frac{2+4+5}{2} = 5.5$
 $= \sqrt{5.5(5.5-2)(5.5-4)(5.5-5)}$
 $= 3.8 \text{ m}^2$
38. A. only A is an identity
39. A. $\frac{\sin^2 \theta}{\cos^2 \theta} = \left(\frac{\sin \theta}{\cos \theta}\right)^2 = \tan^2 \theta$
40. D. $= \frac{1 + \cos \theta}{1 - \cos^2 \theta} + \frac{1 - \cos \theta}{1 + \cos^2 \theta}$
 $= \frac{2}{\sin^2 \theta} = 2 \csc^2 \theta$
41. A. $\cos 37 \cos 23 - \sin 37 \sin 23$
 $= \cos(37 + 23)$
 $= \cos(60)$
 $= \frac{1}{2}$
42. D. $= \cos(2(72^\circ))$
 $= \cos(144^\circ)$
43. C. $= 4\left(\frac{-1}{3}\right)^3 - 3\left(\frac{-1}{3}\right)$
 $= \frac{-4}{27} + 1$
 $= \frac{23}{27}$

$$44. \quad A. \quad = \sin\left(\frac{1}{2}(60)\right) = \sin 30 = \frac{1}{2}$$

$$45. \quad A. \quad \sin \theta \left(\frac{\cos \theta}{\sin \theta} + 1 \right) = \cos \theta + \sin \theta$$

$$46. \quad D. \quad = \cos \beta + \frac{\sin \beta \sin \beta}{\cos \beta}$$

$$= \frac{\cos^2 \beta}{\cos \beta} + \frac{\sin^2 \beta}{\cos \beta}$$

$$= \frac{\cos^2 \beta + \sin^2 \beta}{\cos \beta}$$

$$= \frac{1}{\cos \beta}$$

$$= \sec \beta$$

$$47. \quad D. \quad \frac{\underbrace{\tan A \cot A}_1 + \cot^2 A}{\csc^2 A}$$

$$48. \quad C. \quad \sin^2 \theta = \frac{1}{2} \qquad \therefore \theta = 45^\circ + 90n$$

$$\sin \theta = \pm \sqrt{\frac{1}{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$$

$$= \pm \frac{\sqrt{2}}{2}$$

$$49. \quad C. \quad \sin 2\theta = \frac{\sqrt{3}}{2}$$

$$2\theta = 60 \qquad 2\theta = 120$$

$$\theta = 30 \text{ or } \frac{\pi}{6} \qquad \theta = 60 \text{ or } \frac{\pi}{3}$$

$$50. \quad C. \quad \cos \alpha = \frac{2}{3} \qquad \text{answers in quadrant 1 and 4 } \therefore 2 \text{ solutions}$$